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Empire and useful knowledge: mapping and charting the British American world, 1660-1720

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Declaration

This is to certify that that the work contained within has been composed by me and is entirely my own work. No part of this thesis has been submitted for any other degree or professional qualification.

Signed:

Abstract

Between 1660 and 1720 the British American empire expanded to incorporate new settlements, new trade routes, and it occupied a growing place in the British export economy. This expansion created challenges in transoceanic navigation and understanding of local geography, particularly as ambitions to trade in new markets in Spanish America gained traction. Mariners, merchants, scientists and policymakers required useful knowledge to enable their voyages and imperial activities. To meet this growing demand, print artisans in London produced an increasing amount of printed geographical information in the form of maps, charts and geographical texts. Draftsmen, engravers and printers applied their skill and labour to produce 179 maps and charts of the British Americas, and these artisans in turn benefitted from the income supplied by consumers. The increasing valorisation of empiricism and eyewitness knowledge resulting from the 'scientific revolution' also informed the inclusion of useful and practical information on maps and charts, and publishers asserted their credentials in claims to accuracy and novelty. Crown-sponsored voyages, buccaneers and chartered companies supplied eyewitness information from the Spanish Pacific and Caribbean, although the quality of information varied depending on the voyage itineraries and priorities. The growth of this market for maps and charts of the Americas highlights how the economic and territorial exploitation inherent to British empire was partly enabled by artisans living thousands of miles from colonial spaces. It further demonstrates the pivotal role of empire in Britain's long-term economic growth, and highlights that useful knowledge was central not peripheral to early modern socio-economic development.

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Introduction

In 1711 a sea captain called Nathaniel Uring sailed to the Honduran coast to collect logwood and sarsaparilla. He had received six months of instruction in the 'first rudiments of navigation' under the care of a relation in London.[1] His ship stopped first at Blewfields on the Nicaraguan coast, a place described in privateer accounts published in the 1690s. Uring did not know the area and so he 'had a pilot sent on board […] the other sloop commanded by Capt. Gill who was reckon'd a good pilot in the Part of the world'.[2] However, once the ships reached the Mosquito coast, a storm brought strong wind and high seas. Uring feared the ship would be wrecked in shallow water, writing 'I enquired of my Pilot, in relation to the depth of water, but found he knew nothing of the matter'.[3] He continued, 'I looked on my draught of those seas, which laid down several ledges of rocks and shoals, and expected nothing less than to be thrown on some of them every moment'.[4] He decided to wait along the shoreline hoping for a change of wind.

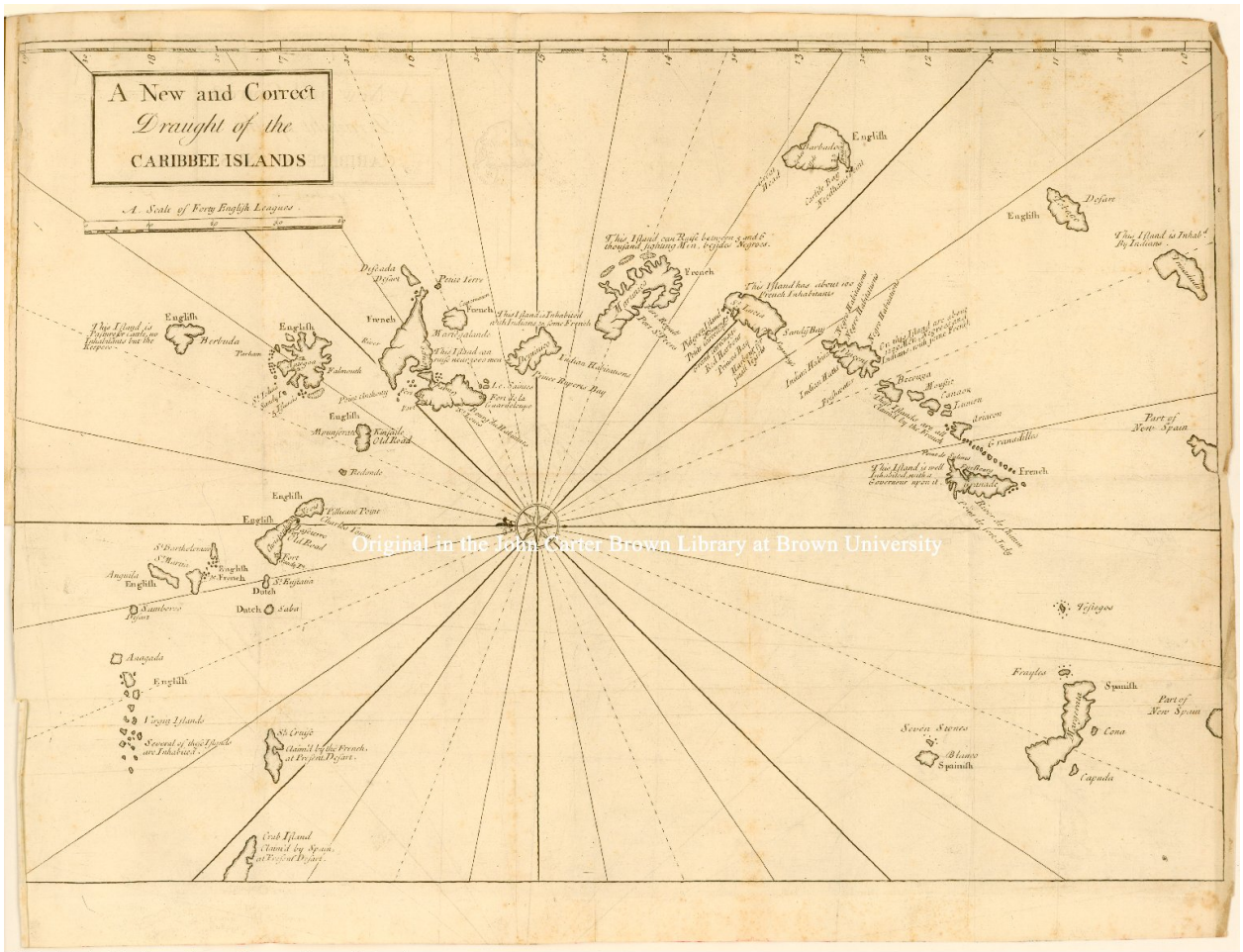
This tension continued between the pilot's knowledge claims and the information Uring observed on his maps. As the ship sailed eastward, the pilot told Uring that he believed the land they saw was Cape Gracia de Dios which he believed was navigable with safe anchoring and five fathom water. However this contradicted Uring's map, which showed rocks and shoals. Uring decided to trust the pilot. However, after the ship struck rocks, losing its mast and gunhill, he wrote 'the pilot had deceived us'. Uring and his crew abandoned the ship and rowed onto shore in a canoe.[5] Uring spent several months in the home of an English log cutter and his wife from an indigenous group, and recorded information from them about rivers Plantane, Great Romain, Limehouse, and Cape Camerone, and towns Vera Cruz and Mexico City. Uring used this information to draw a new map of the region to prevent further accidents. He wrote,

> hearing him describe all the islands and coasts in the Bay of Honduras, and those about us, where he had often travelled to and fro for many Years: and I knowing the Draughts of those parts to be very false, which was the Cause of the Loss of our vessel; for though our pilot was ignorant, if I had had a good Draught of the Coast, I could have preserved the sloop.[6]

To draw the map, he made a 'wooden pair of compasses, and a scale; my ink was made with gun-powder, and my pens with the feathers of wild fowl'.[7] Uring eventually joined a ship that was returning to Jamaica, and published an account in London of his voyages that included a map describing 113 coastal features and islands, a navigation route in the Bay of Honduras and 3 large towns.

[1] Nathaniel Uring, *A history of the voyages and travels of Capt. Nathaniel Uring. With a new draught of the bay of Honduras* (1725), p. 2
[2] Ibid, p. 167
[3] Ibid, p. 168
[4] Ibid, p. 169
[5] Ibid, p. 173
[6] Ibid, p. 221
[7] Ibid, p. 221

Figure 1: Nathaniel Uring, *A new and correct draught of the Caribbee islands* (1725)



The themes highlighted by Uring's experiences - accumulation of geographical information resulting from commercial activity and ambition in British colonial spaces; application of navigation and artisanal skills including pilotage and map drawing to the collection of useful information that supported imperial expansion; and interactions between disparate actors on the fringes of empire or at its heart in London that created geographical knowledge - are the topic of this thesis.[8]

[8] Useful knowledge was gained through observations and manipulations of nature with the aim of solving problems with a material application and usually for commercial gain. It is distinguishable from the observation of nature to satisfy curiosity or to develop scientific principles with a purely intellectual objective. It includes knowledge gained through everyday ordinary practices and activities, often by artisans or experimenters, whose expertise fed into processes of finding solutions. Describing knowledge as 'useful' does not assert that it necessarily had more utility than other forms of information, or indeed that it was useful in the sense of it enabling the solution of a problem. Instead it describes an intended outcome of the process of information or knowledge gathering and is attached to the material outcomes envisioned from the observation and manipulation of nature. Economist Simon Kuznets argued that useful knowledge was the source of modern economic growth. Simon Kuznets, *Economic growth and structure* (New York, 1965). See pp. 12-13 for more recent discussion of useful knowledge

This thesis argues that growth in the volume and value of trade from British American colonies, and ambitions to exploit markets in Spanish America and the Pacific, stimulated demand for geographical knowledge and in turn the British knowledge economy between 1660 and 1720. It identifies demand for geographical and navigation information from mariners and merchants aiming to sail to and trade in the Americas, and from London institutions the Royal Mathematical Society, the Royal Society (founded in 1662 alongside changes to natural knowledge constituting the 'scientific revolution') and civil servants such as Samuel Pepys and the Board of Trade. Ambitions to establish a foothold in Spanish American markets to trade in enslaved people, Spanish bullion and European manufactures were also a source of demand. They generated supply of raw geographical information on a crown-sponsored voyage in 1669, by privateers and buccaneers in the 1680-90s, and from merchant companies in 1690-1710s.[9] It is shown that between 1660 and 1720, the number of maps and charts of the Americas published in London increased significantly, and that for rapidly-growing colonies such as Jamaica, London became the market leader of the trade in Europe. These objects displayed increasing density of information and contained useful knowledge to support navigation and settlement. They were also propaganda tools that promoted the opportunities of empire and asserted the rights of England to occupy and trade in the Americas. The labour and skills applied to produce these maps and charts by draftsmen, engravers and printers was extensive and indicate that print artisans, who are usually not considered part of the imperial economy, played a core role in the creation and extension of British interests in the Americas. Furthermore, London as an increasingly powerful urban centre met the demand for geographical information and benefitted from a boost to the print trade.[10] These arguments highlights intersections in several historical literatures that are usually siloed and add to arguments that the imperial complex wove itself deep into the British knowledge economy.

Historiography

This research brings together literature in economic history on trade, empire and slavery including debates about useful knowledge and the origins of British industrialisation, with histories of early modern natural knowledge, cartography, and artisanal print culture. It also touches upon the history of geographical exploration. Its core contribution to existing scholarship is to highlight how the economic opportunities provided by American colonial trade and settlement contributed to the development of the British knowledge economy by incentivising settlers, mariners and print artisans to apply their skills and labour to produce and consume

[9] The 'scientific revolution' was a series of changes and debates in late 17th century England regarding approaches to understanding nature and formulating scientific knowledge. Broadly speaking it involved a shift from drawing upon ancient forms of written authority to valuing knowledge derived from eyewitness, experimental and empirical methods of observation, often encapsulated in the idea of 'Baconianism' after Francis Bacon's writings in the early 17th century. The term 'scientific revolution' is now jettisoned by many historians as misrepresenting the nature of changes that took place, whilst 'science' is considered anachronistic. See pp. 9-10 for further discussion

[10] Historian of cartography J.B Harley noted that in the 18th century 'London became an entrepôt and clearing-house for the geographical knowledge of a far-flung territorial system', but it did not discuss how this related to the capital's crucial role in the British colonial economy or how it linked to the longer economic development of Britain. J.B. Harley, 'Power and legitimation in the English geographical atlases of the eighteenth century' pp. 161-204 in John A.Wolter and Ronald E.Grim eds., *Images of the world: the atlas through history* (New York, 1997), p. 126

geographical information. It shows that curiosity alone did not drive the accumulation of natural knowledge, but that material ambition was a core factor in developing a culture in England that produced precise, accurate and useful scientific objects such as maps and charts. By focusing too on British interests in Spanish America, it fills gaps in the historiography of empire that normally focusses on North America.

The late-17th century is acknowledged by historians as a period of foundational change in the nature of overseas trade in England. Ralph Davis described the shift from trade in woollen cloth to Europe to plantation and re-export trade as a 'revolution'. Whilst the overall value of trade increased slowly, the value of plantation imports rose by 100% and exports by 150% between 1663-69 and 1699-1701.[11] Nuala Zahedieh demonstrated how the nature of Atlantic trade had distinctive impact on the English economy, highlighting the creation of jobs and deployment of resources in Britain to process colonial commodities, innovation caused by demand placed on scarce resources, for example iron, linen and cotton yarn production, and finally, institutional changes leading to greater financial sophistication caused by the need to manage the risk of long-distance trade.[12] Similarly Davis argued that the demands of plantation trade accelerated the development of the English shipping industry, by requiring additional tonnage for bulkier cargoes, and sturdier armed ships rather than traditional Dutch fly-boats.[13] Other historians have considered the types of skills and knowledge required and generated by colonial trade.[14]

One of the most influential contributions to the long-running debate about links between empire and Britain's leadership in the Industrial Revolution has been the Eric Williams 'overseas extraction' thesis expressed in 1944 in *Capitalism and slavery.*[15] Williams argued extractive plantation commerce and capital, in particular from the Atlantic Slave Trade, caused qualitative changes in the English economy, creating the conditions for English industrialisation. He traced "the investment of profits from the triangular trade in British industry [which] supplied part of the huge outlay for the construction of the vast plants to meet the needs of the new productive process and the new markets."[16] Linked to Williams's arguments about the formulative role of empire in British economic development is the world-systems approach formulated by Andre Gunder Frank, Immanuel Wallerstein and others, who argued that global economic divergence and division post-1800 has its origins in the advantages gained by Western economies between 1450 and 1750 when the terms of trade were

[11] Ralph Davis, 'English foreign trade, 1660-1700', *EHR* Vol.7, No.2 (1954), p. 150
[12] Nuala Zahedieh, *The capital and the colonies. London and the Atlantic economy, 1660-1700* (Cambridge, 2010)
[13] By 1700 sugar was England's second largest import in bulk terms, requiring 23,000 tons of shipping storage. Ralph Davis, *The rise of the English shipping industry in the seventeenth and eighteenth centuries*, (1962), p. 22. Zahedieh, *The capital and the colonies,* p. 152
[14] Robert Brenner, *Merchants and revolution: commercial change, political conflict, and London's overseas traders, 1550-1653* (Cambridge, 1993); Perry Guaci, *The politics of trade: the overseas merchant in state and society, 1660-1720* (Oxford, 2001); John J. McCusker and Russell R. Menard, *The economy of British America, 1607-1789* (Chapel Hill, 1991)
[15] Eric Williams, *Capitalism and slavery* (1944)
[16] Ibid, p. 94

weighted in their favour.[17] Barbara Solow and Stanley Engerman, Joseph E. Inikori and others refined these conclusions, offering evidence for long structural change stimulated by Atlantic trade.[18]

Assessments of the impact on English economic development of the requisite development of knowledge and human capital to support colonial trade have recently revived Williams's arguments. Kenneth Pomeranz argued that the need to understand different environments and the opportunity to learn from experts living in colonial spaces (he uses the example of South China and Southern India) led to a 'solidification of ecological understanding', while knowledge of land management that enabled Northern Europe to fix its problem of dwindling land and fuel resources (Malthusian trap).[19] The colonial extraction complex could also give new life to stagnating domestic industries - Nuala Zahedieh recently highlighted how demand for copper to power sugar refineries in the English Caribbean refreshed the domestic mining industry.[20] This thesis contributes to this literature by assessing the impact of demands of navigating Atlantic geography, which contrasted significantly from European, on Britain's knowledge and skill base.

The role of geography in shaping early empire is implied in histories of colonialism but rarely thoroughly analysed.[21] Ian Steele attributes advances in communication that reduced difficulties of managing the vast Atlantic space to 'a growing market' for geographical information, concluding that 'in the lifetime before 1740, the dangers of North Atlantic travel were considerably reduced […] better charts and maps […] did more for marine safety than the improvements in navigational instruments or the invention of headsails'.[22] However he does not further discuss these 'better charts and maps' and crucially he does not identify the driving force behind the improvement. Other recent contributions include Stuart Schwartz's assessment of how hurricanes shaped the development of the Americas, and Lauren Benton's discussion of how geographical features such as oceans and islands became ammunition in legal battles for territorial sovereignty.[23] Benton also identified the existence of a vast informal empire, in spaces between political boundaries, which is a theme that this thesis touches upon in its analysis of how mariners collected and bought information about oceanic spaces

[17] Andre Gunder Frank, *World accumulation, 1492-1789* (New York, 1978); Andre Gunder Frank, *Dependent accumulation and underdevelopment* (New York, 1979); Immanuel Wallerstein, *The modern world system,* 2 vols (New York, 1974)

[18] Patrick O'Brian famously argued in 1982 that 'the periphery was peripheral', but later re-evaluated his conclusion. Patrick O'Brian, 'European economic development: the contribution of the periphery', *EHR,* 2nd Series, XXXV (1982), pp. 1-18. Barbara L. Solow and Stanley L. Egerman eds., *British capitalism and Caribbean slavery: the legacy of Eric Williams* (London, 1987); Joseph E. Inikori, *African and the industrial revolution in England: a study in international trade and development* (Cambridge, 2002)

[19] Kenneth Pomeranz, *The great divergence: China, Europe and the making of the modern world economy* (Princeton, 2000), p. 58. Pomeranz is cautious about over-extending this argument. He maintains that the influence of empire did not alone create the technological shift that led to the increasing use of coal to replace fuel wood and for industrial processes. For discussion of the role of technology in the Industrial Revolution see David S. Landes, *The unbound prometheus* (Cambridge, 1969); Joel Mokyr, *The gifts of Athena: historical origins of the knowledge economy* (Princeton, 2002)

[20] Zahedieh, *The capital and the colonies;* Zahedieh, 'Colonies, copper and the market for inventive activity in England and Wales, 1680-1730', *EHR*, 66 (2013), pp. 805-825

[21] The latter phases of empire have received more attention from historians and geographers, particularly as the British empire was extended and consolidated and as 'geography' itself became a more formal enterprise. See Felix Driver, *Geography militant: cultures of exploration and empire* (Cambridge, 2001)

[22] Ian K. Steele, *The English Atlantic 1675-1740: an exploration of communication and community* (Oxford, 1976), pp. 14, 274

[23] Stuart B. Schwartz, *Sea of storms: a history of hurricanes in the greater Caribbean from Columbus to Katrina* (Princeton, 2015); Lauren Benton, *A search for sovereignty: law and geography in European empires, 1400-1900* (Cambridge, 2009)

outside the legally defined British empire. The market for information to understand, overcome and exploit the challenges of American geography are at the core of this thesis.

Historians of science have paid greater attention to natural knowledge in the late-17th century.[24] In 1931 Boris Hessen presented a seminal argument about how commercial and maritime expansion impacted British geographical and practical mathematical knowledge.[25] "The dazzling flowering of natural science during the 16th and 17th centuries resulted from the disintegration of the feudal economy, the development of merchant capital, of international maritime relations and of heavy (mining and metallurgical) industry," Hessen argued.[26] Links between expansion and science was also discussed by J.A. Bennett in his assessment of how the search for the North-West passage in North America influenced supply and demand of practical mathematics in the form of navigation knowledge.[27] Richard Drayton made an explicit argument in 1998 about the impact of imperial expansion, commerce and navigation on knowledge accumulation in London.[28] Drayton analysed in 2000 how imperial expansion affected the 'sciences of collection and comparison', arguing that this knowledge played practical and ideological roles in building the British empire.[29] This thesis argues that maps and charts too played this role. In the 1980s Simon Schaffer, Steven Shapin and others in the 'science studies' school emphasised the importance of understanding natural philosophy in its intellectual context and from the perspective of historical actors.[30] Lorraine Daston, David Livingstone, Lissa Roberts, Schaffer, Shapin and Charles W. J. Withers have analysed how sites of knowledge production, observation methods, circulation, diffusion and networks condition scientific knowledge.[31] Following the lead of Michael Polanyi, historians have also emphasised the importance of tacit knowledge - 'know-how' and expertise gained through practice - which

[24] In 2005 historical geographer Charles W.J. Withers argued that historians of science should consider the scientific revolution as a 'geographical matter', identifying that mapmaking and navigation are usually relegated to the 'role of secondary discourses'. Charles W.J. Withers, 'Geography, science, and the Scientific Revolution' in David N. Livingstone and Charles W.J. Withers eds., *Geography and revolution* (Chicago, 2005) pp. 75-100. Steven Harris, Steven Shapin and David Turnbull are amongst historians who have discussed geography and place in relation to science. Steven J. Harris, 'Long-distance corporations, big science and the geography of knowledge' in Mario Biagioli and Steven J. Harris, eds., *The Scientific Revolution as narrative*, special issue of Configurations 6 (1998); Steven Shapin, 'Placing the view from nowhere: historical and sociological problems in the location of science', *Transactions of the Institute of British Geographers* 23 (1998); David Turnbull, 'Cartography and science in early modern Europe: mapping the construction of knowledge spaces', *Science in Context* 4 (1991)

[25] Boris Hessen 'The social and economic roots of Newton's Mechanics' in Gideon Freudenthal and Peter McLaughlin, eds., *The social and economic roots of the scientific revolution* (Dordrecht, 2009) pp. 41-101

[26] Ibid, p46

[27] J.A. Bennett, 'The Mechanic's Philosophy and the Mechanical Philosophy', *Hist Sci* XXIV (1986)

[28] Richard Drayton, 'Knowledge and empire' in *The Oxford history of British Empire: Volume II: The 18th Century* (Oxford, 1998) pp. 231-252

[29] Drayton, *Nature's government: science, imperial Britain, and the 'improvement' of the world* (New Haven, Conn., 2000)

[30] Shapin famously opened his book *The Scientific Revolution* writing, 'There was no such thing as the Scientific Revolution and this is a book about it', Steven Shapin, *The Scientific Revolution* (Chicago, 1996), p. 1. A selection from the extensive literature about the Scientific Revolution includes I. Bernhard Cohen, *The revolution in science* (Cambridge, 1985); Andrew Cunningham and Perry Williams, "De-centering the 'Big Picture': the origins of modern science and the modern origins of science," *BJHS* 26 (1993) pp. 407–32; Peter Dear, ed., *The scientific enterprise in early modern Europe: readings from "Isis"* (Chicago, 1997); John Henry, *The Scientific Revolution and the origins of modern science* (Basingstoke, 1997); Margaret J. Ostler, ed., *Rethinking the Scientific Revolution* (Chicago, 2000); Simon Schaffer and Steven Shapin, *Leviathan and the air-pump: Hobbes, Boyle, and the experimental life* (Princeton, 1985); Steven Shapin, *A social history of truth: civility and science in seventeenth-century England* (Chicago, 1994) and *Never pure: historical studies of science as if it was produced by people with bodies, situated in time, space, culture and society, and struggling for credibility and authority* (Baltimore, 2010); Charles W. J. Withers, 'Place and the "spatial turn" in geography and history", *Journal of the History of Ideas* Vol. 70, No. 4 (2009), pp. 637-658

[31] Lorraine Daston, Elizabeth Lunbeck eds., *Histories of scientific observation* (Chicago, 2011); Karel Davids, 'On machines, self-organisation and the global traveling of knowledge, circa 1500-1900' *Isis* Vol 106, No. 4 (2015), pp. 866-874; David N. Livingstone, *Putting science in its place* (2003); Pamela O. Long, 'Trading zones in early modern Europe' *Isis* Vol. 106 No.4 (2015), pp. 840-847; Lissa Roberts, 'Producing (in) Europe and Asia, 1750-1850' *Isis* Vol. 106, No.4 (2015), pp. 857-865; Simon Schaffer, 'Newton on the beach: the information order of Principia Matematica' *History of Science* 47 (157) pp. 243-276 (2009)

has brought ordinary actors such as artisans and mariners to the forefront.[32] Nicholas Dew and James Delbourgo argued that it is imperative to explore the intersection of knowledge production and commerce networks in the Atlantic. However, analysis of economic incentives is absent from their analysis.[33] Kathleen Murphy identified that the movement of botanical information and objects interactions was facilitated by interactions between royal agents and informants in 18th century British West Florida, while Richard Drayton argued that increased efficiency of control over English colonies brought new seeds and plants back to Kew Gardens in the 18th and 19th centuries.[34] The role of precision instruments in making observations far from the usual centres of scientific observation in Europe has also been studied, including Daston's discussion of Edmond Halley's trade winds maps.[35] However, her focus on Halley ignores the broader context of the quotidian collection and use of information by seafarers involved in transporting goods across the Atlantic. This thesis adds to discussions of the role of commercial incentive and demands of overseas trade in the development of empire and science.

Finally, the relationship between utility and science has not been thoroughly explored. In the 1930s Robert K. Merton argued that pursuit of material advantage drove developments in science, and Michael Hunter and Kathleen S. Och discussed interest in collecting information useful to trades by Royal Society members John Evelyn and Robert Hooke.[36] However, these efforts are explained by curiosity and intellectual ambition and explorations of knowledge creation to solve specific problems or to exploit natural conditions for economic gain are limited. Indeed Hunter argued that utilitarianism was a short-lived experiment that died in the 1680s.[37] On the other hand, useful knowledge has become a focus of economic historians including Maxine Berg, Margaret C. Jacob, Joel Mokyr and Larry Stewart, who have nuanced traditional explanations for long-term European economic growth.[38] Traditionally scholars pointed to demographic, institutional,

[32] Harry Collins, *Tacit and explicit knowledge* (Chicago, 2010); Michael Polanyi, *The tacit dimension* (New York, 1966)
[33] James Delbourgo and Nicholas Dew, 'Introduction', in James Delbourgo and Nicholas Dew eds., *Science and empire in the Atlantic world* (New York, 2008) p. 11
[34] Kathleen Murphy, 'To make Florida answer to its name: John Ellis, Bernard Romans and the Atlantic science of British West Florida', *British Journal for the History of Science* 47(1): 43-65 (2014) and 'Collecting slave traders: James Petiver, natural history, and the British slave trade', *WMQ* 3rd ser. 70 No.4, pp. 637- 670. Ted Binnema discussed the collection of scientific knowledge to service the Hudson's Bay Company commercial activities. Ted Binnema, *Enlightened zeal: the Hudsons Bay Company and scientific networks, 1670-1870* (Toronto, 2014)
[35] Marie-Noelle Bourget, Christian Licoppe, H. Otto Sibum eds., *Instruments, travel and science: itineraries of precision from the seventeenth and eighteenth centuries* (2002); Lorraine Daston, 'The empire of observation, 1600-1800' pp. 81-114 in Lorraine Daston and Elizabeth Lunbeck eds., *Histories of scientific observation* (Chicago, 2011), p. 91
[36] Kathleen S. Och, 'The Royal Society of London's history of trades programme: an early episode in applied science', *Notes and records of the Royal Society of London,* Vol. 39, No.2 (April, 1985), pp. 129-158
[37] Michael Hunter, *Science and society in Restoration England* (Cambridge, 1981) pp. 89-90
[38] Maxine Berg, 'Skill, craft and histories of Industrialisation in Europe and Asia', *Transactions of the Royal Historical Society*, 24, (2015), pp. 127-148; Berg, 'Useful knowledge, industrial enlightenment and the place of India', *Journal of Global History* 8:1 (2013) pp. 117-141; Margaret C. Jacob, *The first knowledge economy: human capital and the European economy, 1750-1850* (Cambridge, 2014); Margaret C. Jacob, *Scientific culture and the making of the industrial West* (New York, 1997); Margaret C. Jacob and Larry Stewart, *Practical matter: Newton's science in the service of industry and empire, 1687-1851* (Cambridge, Mass., 2004); Joel Mokyr, *The enlightened economy: an economic history of Britain, 1700-1850* (Princeton, 2010); Larry Stewart, Margaret Jacob refers to the approach taken by historians focusing on a knowledge economy as 'cultural' or focused on 'culture'. Although traditional cultural historians or cultural anthropologists may not fully recognise Jacob's definition of culture as 'education and knowledge', Jacob's point that by looking at factors like 'wider circulation of information, new teaching venues, and curricular reforms' distinguishes their work from the traditional focus of economic historians on wage data, demographic change, and more recently, econometrics, is convincing. Margaret C. Jacob, *The first knowledge economy,* pp. 4-5

commercial and natural factors including abundance of coal to account for Britain's early and rapid industrialisation,[39] However historians have not explained how or why at this particular juncture Britain was able to exploit its energy capital and begin large-scale coal extraction, suggesting that historians need to understand the knowledge culture that enabled the solving of industrial problems.[40] Stewart suggests that proliferation of pre-industrial mathematical, technological or philosophical knowledge can be traced to increased legitimation of scientific activity for its public utility.[41] Joel Mokyr argued that the unique ability of British men and women to produce and acquire useful knowledge, and to transform tacit and informal knowledge into information that was formalised and accessible with low cost of acquisition was crucial to the Industrial Revolution.[42] But limitations remain in the study of scientific knowledge economies. Jacob and Stewart focus in particular 'big name' innovators like James Watt and Matthew Boulton, or isolated individuals working alone in their laboratory or workshop.[43] This focus on 'industrious' individuals obscures ordinary actors such as mariners or print artisans whose quotidian skill and labour was applied collectively, and it overlooks 'slow-burning' generation of knowledge such as observation of maritime conditions or drawing and engraving geographical information in favour of concerted efforts to solve industrial problems. They look for evidence of innovation in artisan trades or industries at the expense of areas where knowledge 'advanced' slowly or was dependent on previously existing capacities.[44] Finally science and knowledge production beyond European shores are overlooked. This research begins to fill this gap by discussing the development of skills and knowledge required to build geographical understanding to service Britain's expanding empire.[45]

Historians of science increasingly focus on material and artisanal culture, including print production.[46] In a ground-breaking collection Lissa Roberts, Simon Schaffer and Peter Dear claimed that artisans' hands and skills were crucial to the production of natural knowledge and technology.[47] Lorraine Daston, Susan

[39] The prime position of Britain in a global process of industrialisation has been challenged recently by work considering the levels of industrialisation in Asia, in particular in China. See R. C. Allen, *The British Industrial Revolution in global perspective* (Cambridge, 2009); Prasannan Parthasarathi, 'Rethinking wages and competitiveness in the eighteenth century: Britain and south India', *Past and Present*, 158 (1998), pp. 79-109; Pomeranz, *The great divergence*

[40] This is a summary of Margaret Jacob's argument in *The first knowledge economy* p. 2, regarding work by E.A Wrigley, "In quest for the Industrial Revolution", *Proceedings of the British Academy,* 2003 Vol. 121, pp. 168-70 and *Energy and the Industrial Revolution* (Cambridge, 2010), pp. 44-7

[41] Larry Stewart, *The rise of public science: rhetoric, technology, and natural philosophy in Newtonian Britain, 1660-1750* (1992), pp. xvii-xxx

[42] Like Kuznets, Mokyr argues 'the growth of useful knowledge is at the centre of modern growth'. Joel Mokyr, *The enlightened economy*, p.9. See by the same author, *The lever of riches: technological creativity and economic progress* (Oxford, 1990); *The gifts of Athena: historical origins of the knowledge economy* (Princeton, 2002)

[43] Jacob, *The first knowledge economy;* Jacob and Stewart, *Practical matter*

[44] John Styles makes a similar point about the origins of the Spinning Jenny and the Arkwright frame stretching back to the late medieval period. John Styles, 'Fashion, textiles and the origins of the Industrial Revolution' *East Asian Journal of British History,* Vol. 5 (2016), pp. 161-189

[45] In focussing on the nation-state Jacob, Mokyr and Stewart leave little room for transnational movement of information, which runs at odds with recent global histories of knowledge that emphasis that knowledge is fluid and moved across borders with human migration, political events, print culture, and with trade. Although Jacob emphasises that studies of European knowledge economies is not a de facto valorisation of European science, it remains the case that the dominant approach to early modern knowledge economies disregards the role of non-European contexts or environments in creating epistemologies or skills. However, as William Ashworth pointed out, focussing on the role of empire in useful knowledge economies can offset some implications of innate exceptionalism in narratives of the British-ness of the Industrial Revolution. W. J Ashworth, 'The industrial revolution and the ideological revolution: science, neoliberalism and history' *History of Science*, 52 (3) (2014) pp. 178-199

[46] Focus on the material world by historians in science is traced back to at least Steven Shapin and Simon Schaffer, *Leviathon and the air-pump: Hobbes, Boyle, and the experimental life* (Princeton, 1985); Peter Galison, *Image and logic: a material culture of microphysics* (Chicago, 1997); H. Otto Sibum, 'Reworking the mechanical value of heat: instruments of precision and gestures of accuracy in early Victorian England' *Studies in History and Philosophy of Science Part A* Vol. 26 (1995), pp. 73-106

[47] Lissa Roberts, Simon Schaffer, Peter Dear eds., *The mindful hand: inquiry and invention from the late Renaissance to early industrialisation* (Amsterdam, 2007)

Dackerman, Katherine Park claim to investigate 'close working-relationships between the artistic and scientific communities' and argue that print-making was a 'matrix for the production of knowledge'.[48] However, analysis of printed map production is limited to a note that new editions of Ptolomy's *Geography* driven by 'interest in expanded trade routes, and the desire for greater knowledge of the world drove an enormous growth in the making and the use of maps', without further elaboration.[49]

On the other hand, the history of cartography is rich in monographs and beautifully-illustrated books celebrating map-making.[50] Traditionally they focus in detail on the maps and sometimes the mapmakers, neglecting analysis of their economic or political context. J. H. Andrews has comprehensively described methods of surveying, mapping and publishing but neglected explanation of the many changes, developments, innovations and failures.[51] Other historians have documented mapmaking techniques in Europe, including the progression from woodcut to intaglio engraving.[52] More recently, historians of art and science have valuably foregrounded the artisanal complexity of early modern prints and their increasing use in communicating scientific information, building on comments by William M. Irvins Jr. that print-making could deliver an 'exact repeatability of communication', visual artists furthered science by making a new mode of visual communication possible.[53] Peter Parshall suggests that in Renaissance Europe prints increased the status and authority of visual evidence, and Landau and Parshall write that 'accurate visual representation was more than just a technical accomplishment. It was a highly specialised form of observation'.[54] This thesis adopts this recognition of the link between prints and science. It argues that when the technical complexities of map engraving and the dependency of accurate scientific communication on the skill of the printmaker are considered, the scope of work required to produce maps of the Americas further highlights the scale of responsibility placed on print artisans working far from the imperial periphery to produce valuable information.

Scholarship also traditionally sought to chart how historical cartography journeyed towards meeting modern geographical standards. Lloyd Brown aimed 'to confine the story to a straight and more or less narrow path, to keep to close to the line of progress', while G.R. Crone wrote that 'the history of cartography is largely that of the increase in the accuracy with which these elements of distance and direction are determined'.[55] This whiggish impulse declined after coming under heavy criticism from historical geographers such as J.B. Harley

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[48] Susan Dackerman, 'Introduction: prints as instruments' in Susan Dackerman ed. *Prints and the pursuit of knowledge in early modern Europe* (2011), p. 19
[49] Ibid, pp. 19, 317
[50] Geoff Armitage and Ashley Bayton-Williams, *The world at their fingertips: eighteenth-century British two-sheet double-hemisphere world maps* (2012); Chet Van Duzer, *Sea monsters on medieval and renaissance maps* (2013); P. D. A. Harvey, *The history of topographical maps: symbols, pictures and surveys* (London, 1980); R.A. Skelton, *Maps: a history survey of their study and collecting* (Chicago, 1975)
[51] J.H. Andrews, *Maps in those days: cartographic methods before 1850* (Dublin, 2009)
[52] David Woodward ed., *Five centuries of map printing* (Chicago, 1975)
[53] William M. Irvins Jr., *Prints and visual communications* (Cambridge, 1953), p. 161
[54] David Landau and Peter Parshall, *The Renaissance print 1470-1550,* (New Haven, Conn., 2005) pp. 257-8. Innovation in printmaking and printing has been discussed by historians of the Industrial Revolution and the Enlightenment. Aileen Fyfe discusses the role of the steam press in changing newspaper production and circulation times, and Adrian Johns discusses how the craft world had to adapt to changes in print techniques in the Industrial Era, in particular steam power printing and stereotyping. Adrian Johns, 'The identity engine: printing and publishing at the beginning of the knowledge economy' in Lissa Roberts, Simon Schaffer, Peter Dear eds., *The mindful hand,* pp. 403-441
[55] Lloyd A. Brown, *The story of maps* (1949) p. 4; G. R Crone, *Maps and their makers: an introduction to the history of cartography* (1953), p. *xi*

who argued, 'even scientific maps are a product not only of 'the rules of the order of geometry and reason' but also of the norms and values of the order of social […] tradition'.[56] More recently, Matthew H. Edney argued that social needs, power relations and cultural conventions underpin the production and use of maps.[57] In identifying that maps reflect contemporary social norms, these scholars highlighted that maps reveal the values and priorities of the society and economy that produced them, including interests in commercially useful knowledge, as in the case of maps of British America.

The English map trade has been seriously studied by prominent historians including E.G.R Taylor who placed the biographies of publishers and instrument makers Robert Morden, Joseph Moxon and John Seller, in the context of changing place of natural knowledge, writing 'mathematics and the new philosophy were to take their place among the favourite topics of the wits in the coffee-houses'.[58] Sarah Tyacke documented growth in the map trade using the scant surviving evidence and described over 40 active publishers in 1660-1720.[59] Meanwhile historians of science like Lisa Jardine focused on investment by Robert Hooke in cartography including Moses Pitt's 'English Atlas' and John Ogilby's 'Brittania' in the 1670-80s.[60] However these accounts did not assess commercial or imperial demand or explain consumption of maps and charts. Other historians emphasise the lack of skill and innovation in the trade, adopting Samuel Pepys condemnation of map publisher John Seller: 'Seller's book in 1668 was the very same platts [as] the Dutch without a Dutch word so much as turned into English much less anything in the maps altered'. Pepys's criticism has echoed through the history of cartography; however these criticisms judge their aesthetic quality and visual novelty, ignoring the labour and skill required to copy cartographic information or refurbish a copper plate.[61] English map makers have also been considered inferior to their continental rivals. G.R Crone writes that British cartographers 'followed, often with a considerable time lag, the practice of their contemporaries in Portugal, Italy, the Low Countries and France'. However, as will be seen, English leadership in maps of colonies like Jamaica suggests that in cases where imperial expansion demanded supply, artisans could outperform their European counterparts.

English map makers were also considered to be good at producing outdated or even useless maps.

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[56] J. B. Harley, 'Deconstructing the map', *Cartographica* v. 26 no. 2 (1989) pp. 1-20, p. 2. Harley was an influential historical geographer specialising in history of cartography. He authored over 20 essays that challenged traditional interpretations of maps as simply graphic scientific representations to be scrutinised for accuracy, and offered methods for deconstructing the meanings he argued were contained within maps. For a selection of essays as well as critique of Harley's interpretations by J.H. Andrews see J.B. Harley, Paul Laxton, ed., *The new nature of maps: essays in the history of cartography* (Baltimore, 2001)

[57] Matthew H. Edney, 'Mapping parts of the world' in James Akerman ed., *Maps: finding our place in the world* (Chicago, 2007)

[58] E.G.R. Taylor, *Mathematical practitioners in Stuart and Tudor England* (1954). Also see Norman J. Thrower ed., *The compleat plattmaker: essays on chart, map and globe making in England in the 17th and 18th centuries* (1978); Helen Wallis and Sarah Tyacke eds., *My head is a map; essays on carto-bibliography in honour of R.V. Tooley* (1973)

[59] Tyacke writes that there are few traces of cartographic production for the London trade except the maps themselves. See also Helen Wallis, 'Geographie is better than divinitie: maps, globes and geography in the days of Samuel Pepys', pp. 1-42 in Thrower ed., *The compleat plattmaker*; Tyacke, 'Map sellers and the London map trade c.1650-1710' in Wallis and Tyacke eds., *My head is a map*, pp. 63-80

[60] Lisa Jardine, *Ingenious Pursuits* (1999), pp. 177-222. Also see E.G.R. Taylor, "The English Atlas, 1680-1683' *The Geographical Journal* Vol. 95, No.4 (1940), pp. 292-299

[61] Historians including J.H Elliot, William P. Cumming and Coolie Verner have repeated the idea that English-made maps in the late seventeenth century were poor or inferior to Dutch and French. J.H. Elliot, *Empires of the Atlantic World: Britain and Spain in America 1491-1830* (New Haven, Conn., 2007); Coolie Verner 'John Seller and the chart trade in seventeenth century England' in Norman J. Thrower ed., *The Compleat Plattmaker: essays on chart, map and globe making in England in the 17th and 18th Centuries* (1978), pp. 127-158; William P. Cumming, *British maps of colonial America* (Chicago, 1973)

Samuel Pepys noted in his diary that the maps made and sold by contemporary and high-profile map publisher John Seller "are at the best but copies of the Dutch, with such improvements as he can make therein by private advice".[62] Extant maps are considered to be 'gifts, household decoration or [for] public display rather than working documents', or their utility is overlooked in favour of political or social functions.[63] This is partly the result of the cultural turn in historical studies, which led historians to interrogate maps for hidden meanings and for their role as projectors of ideology.[64] Harley used an 'iconographical' approach to 'explore the discourse of maps in the context of political power' and suggests that the accuracy of information and the geographical content of maps should not be a primary focus of historians.[65] However, analysis of mariner's inventories, purchases by the Royal Mathematical School and the Darien Company, and of maps and charts, suggests that even extant maps and charts were useful objects that communicated valuable geographical and navigation information. Detail such as rocks, water depths, harbours and rhumb lines increased, while the volume of decorative information like sea monsters and elaborate cartouches decreased. Map publishers also asserted the utility and accuracy of their products, as part of a strategy to sell their objects by appealing to the consumer's Dessire for useful information, highlighting utility as currency. This process of standardisation of cartographic information has not been ignored by historians, including Harley who argued that in the 18th century, 'rules, specifications, techniques and regular arrays of conventional signs were tools of normalisation [which] enabled the Crown to assert Royal prerogative and 'the inherent superiority of the English over other nations'.[66] However, he did not analyse why these rules and specifications changed, the economic background, and what these maps and charts enabled consumers to do in the British empire.[67] Pepys's comment that John Seller bought old Dutch maps or copper plates to refurbish them and sell as his own may have reflected an unease about the provenance of maps sold in London and warns historians against assuming that increased production and sales of maps in the capital meant that publishers in England were out-pacing their continental rivals; however it does not mean that London could not become a clearing house for scientific information related to empire and cartography, as growing numbers of merchants and mariners operated out of the city, as well as a growing magnet for artisans and information from across Europe used to produce maps and charts. This research argues that increased use of rules and recognisable navigation and geographical codes reflected growing demand for geographical information to solve problems of cross-Atlantic navigation, long-distance trade and colonial settlement. Whilst this thesis does not aim to determine the geographical accuracy of the maps, it argues that the contents of the maps did matter, because they represent growing resources invested in collecting valuable information about empire as well as a growing ability of the colonial metropolis and artisans involved

[62] J.P. Tanner, *Samuel Pepys Naval Minutes* (London, 1926) p. 135
[63] Diane Dillon, 'Consuming Maps' in Akerman ed., *Maps,* p. 293
[64] Akerman, 'Finding our way' in ibid, pp. 19-64
[65] J.B. Harley, 'Maps, knowledge and power' pp. 277-312 in Denis Cosgrove and Stephen Daniels eds., *The iconography of landscape: essays on the symbolic representation, design and use of past environments* (Cambridge, 1988), p. 278
[66] Harley, 'Power and legitimation in the English geographical atlases' pp. 115, 147
[67] Ibid, p113

in map trade to represent colonial geography on printed maps and charts, and therefore enable colonial enterprise.

Historians rarely study English trade in colonial or imperial maps.[68] One exception is Lesley Cormack, who discussed how the Elizabethan idea of empire was constructed through geographical descriptions.[69] William P. Cumming briefly discussed efforts to chart the coast of colonial North America, but argues that changes to maps were made only reluctantly.[70] The role of mapping in constructing and legitimising empire continues to be a dominant theme, particularly in the 18th and 19th centuries. Matthew Edney argued that British colonists in India used surveying techniques to create a spatial image of empire as well as legitimise colonial activities.[71] Like Harley, David Woodward argued that maps of empire were tools to legitimise settlement, whilst D.W. Meinig argued that in North America 'the very lines on the map exhibited this imperial power and process'.[72] This focus on cartography as a tool for legitimation, coercion and violence is a welcome addition to imperial history. However their assessment of political functions overlooks the role of cartographic knowledge in enabling other everyday activities of empire, such as navigation or identifying harbours for trade. The historiography also has strong focus on the 13 colonies, and neglects British spheres of interest in Spanish America, and the informal spaces of empire in the Atlantic and Pacific oceans and the Carribbean sea.[73] This thesis brings a systematic approach to discussion of early colonial maps of the Americas, analysing 179 maps of the Americas published in London, and placing their production in the context of growing commercial incentives for expanding geographical knowledge. This moves the function of maps beyond objects with strong symbolic and political value, to include their role in enabling commercial expansion as well as how the demands of empire acted as a motor behind the map trade and associated skills.

Methods and definitions

It is unlikely that early modern European observers would recognise the 'Atlantic World' or the 'Americas' as a coherent or logical conceptual space. Names on maps of the North and South Atlantic oceans ranged from *Ethiopian Sea* to *Southern Ocean and Western Ocean* and *Atlantick Ocean* while the American landmass was portrayed

[68] Catherine Delano-Smith and Roger J.P. Kain describe map-making methods and surveying of towns and counties from medieval period to late 18th century and Hydrographic Office, but devote little attention to maps of empire. Catherine Delano-Smith and Roger J.P. Kain, *English maps: a history* (1999)

[69] Lesley B. Cormack, 'The fashioning of an empire: geography and the state in Elizabethan England' in Anne Godlewska, Neil Smith, *Geography and empire* (Oxford, 1994) pp. 15-30; Lesley B. Cormack, *Charting an empire: geography at the English universities, 1580–1620* (Chicago, 1997)

[70] Cumming, *British maps of colonial America*, pp. 39-42. Cumming also asserted that mercantile demand lay behind the map trade expansion but provided little empirical evidence for his claim. This research develops his argument

[71] Matthew Edney, *Mapping an empire: the geographical construction of British India, 1765-1843* (Chicago, 1999)

[72] D. W. Meinig, *The shaping of America: a geographical perspective on 500 years of history* vol. 1, *Atlantic America, 1492-1800* (New Haven, 1986), p. 232; J.B. Harley, 'Silences and secrecy: the hidden agenda of cartography in early modern Europe', *Imago Mundi*, 40 (1988), pp. 55-76, and 'Deconstructing the map', *Cartographica*, 26, No.2 (1989), pp. 1-20; Harley and Woodward, 'Concluding Remarks' in Harley and Woodward eds., *History of cartography,* vol. 1 *Cartography in prehistorica, ancient and medieval Europe and the Mediterranean* (Chicago, 1987)

[73] David Buisseret, *Rural images: estate maps in the old and new worlds* (Chicago, 1996); Philip D. Burden, *The mapping of North America: a list of printed maps 1511-1670* (Stamford, Connecticut, 1996); Philip D. Burden, *The mapping of North America II: a list of printed maps 1671-1700* (Stamford, Conn., 1996). One exception is Barry Higman, *Jamaica surveyed: plantation maps and plans of the eighteenth and nineteenth century* (Kingston, 2001)

in various sizes and shapes.[74] Yet for mariners, merchants, and enslaved people that crossed the oceans between Europe and Africa and the American continent, the distance and links between the numerous entrepôts, ports and harbours formed a structure that governed their individual lives and the nature of economic exploitation and development of Europe and the Americas. This research uses the British American world as the core geographical unit of analysis, including the 13 colonies in North America, British Caribbean colonies, and Spanish America as a region of growing economic interest.[75] This unit includes the nautical space around the American continents, in particular the southern and northern Atlantic ocean, but also the Caribbean and Pacific ocean. Although they were not coherent political units, oceans were a core part of the infrastructure and ecology of empire (as well as contested spaces) - crossing the Atlantic was a pre-requisite to any European colonial trade. As Zahedieh and Gregory O'Malley highlighted, inter-colonial trade in enslaved people was prominent in the Americas and made Caribbean ports like Bridgetown and Kingston into 'hubs of transshipment'.[76] This highlights the complex layers of geographical exchange structured into the European American system and the importance of factoring into analysis the informal and 'in-between' spaces of empire. By connecting analysis of both north and south American continents and including oceans, the research offers a more holistic assessment of British imperial history in the Americas than traditional Atlantic or imperial history which often focusses on politically-defined landmasses.

London was largely at the centre of the trade and knowledge production assessed in this research and it overwhelmingly reaped the benefits of imperial expansion. This means that London holds a dominant position in this analysis of empire, despite calls by historians to 'flatten' the relationship between metropole and periphery. At the same time, the focus in chapters 3, 4 and 5 on collection of information in the South Seas and in Spanish Caribbean highlight the core role that activity in distant spaces could have on the British economy. The thesis focusses on the map and chart trade in London, rather than other British cities, because London served and benefitted from the lion's share of Atlantic trade and was home to the majority of English map publishers.[77] Although cartographic information was (and still is) represented in many different forms,

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[74] John Thornton, *A new mapp of the world* (1683); Edmund Halley, *A new and correct chart* (1700); Herman Moll, *A map of the West Indies or the islands of America* (1709)

[75] The British Atlantic world is a more traditional unit for historians of empire. Since Bernard Bailyn's foundational writings on the Atlantic world, historians have analysed topics such as trans-Atlantic slavery, revolutionary political thought and events, the European trading companies, and commodity exchange within this framework. Some scholars have suggested taking a 'systems' approach, including Meinig who writes that the Atlantic world was 'the scene of a vast interaction rather than merely the transfer of Europeans onto American shores'. David Armitage describes three concepts of Atlantic history: 'Circum-Atlantic history' which is the transnational history of the Atlantic world; 'Trans-Atlantic history', the international history of the Atlantic world, and 'Cis-Atlantic history'. David Armitage, 'Three Concepts of Atlantic History' pp. 13-29 in David Armitage and Michael J. Braddick eds., *British Atlantic world, 1500-1800*, 2nd. Edition (Basingstoke, 2002). Recently, there have been calls to broaden perspectives to include other European powers and Spanish America in particular. However this does not include British interests or activities in Spanish America or the Pacific, which is contained within a siloed historiography and treated as a fully distinct space

[76] Nuala Zahedieh, 'The merchants of Port Royal, Jamaica and Spanish contraband trade, 1655-92' *WMQ* (1986) pp. 570-93; Gregory O'Malley, *Final passages: the inter-colonial slave trade of British America, 1619-1807* (Williamsburg, Virginia, 2014) pp. 6-7, 11

[77] The centrality of London to the Atlantic economy is highlighted by Nuala Zahedieh's focus on London in her assessment of colonial merchants 1660-1700. She argues 'London's combination of functions was unique among European cities and gave its citizens a competitive advantage when embarking on the extension and consolidation of empire'. Between 1699 and 1701 London handled 80% of England's colonial imports, 65% of exports to the colonies, and 85% of re-exports, and naturally housed the shipping and labour infrastructure that accompanied this level of trade. London also controlled three-quarters of England's general overseas trade and owned almost half the English merchant fleet. Peter Earle, *Making of the*

including in manuscript form, drawings, text and maps or charts, the research focuses largely on printed maps and charts due to the role of printed information, rather than manuscript, as a transmitter of useful knowledge. Printing is central to the idea of useful knowledge because it increased the accessibility of information and made it subject to a process of standardisation meaning that users would view and apply the same information (at least within the same print run).[78] Unlike manuscripts, access to print was limited only by literacy and available capital, and the growing map market across Europe indicates that consumers were interested in buying maps. Analysing the increase in printed maps enables this research to understand not only collected geographical information, but information that was accessible to a wide range of British society in the late 17th century. Chapters 3-5 also analyse manuscript geographical knowledge about Spanish America, but discuss transfer to printed maps. Although maps and charts are clearly distinguished between by cartographic historians as distinct items – maps referring to land and charts to water – there was less distinction in this period. Printed maps frequently included navigation information such as rhumb lines or rock markings, while charts included terrestrial information. Publishers also sold both types. Nonetheless contemporary observers would consider a map to be a different object to a chart. This thesis takes the approach of acknowledging the difference between the two types of cartographic object and information, but by necessity of the combination of forms of information on contemporary maps and charts as well as the aggregation of the trades, it frequently does not explicitly refer to maps and charts separately in analysis.

Why focus on 1660-1720? In these sixty years the British colonial enterprise transformed from a fledgling set of colonies with minimal trade returns to one that punched above its weight in the volume and value of trade. England's plantation tonnage almost doubled from 1663 to 1686, and from 1668 onwards 335 ships a year entered London from the Atlantic colonies.[79] The post-Restoration period and the founding of the Royal Society in 1662 signalled a shift in English political and scientific culture. By 1720 stronger state-sponsored groups to manage production of scientific and geographic information were emerging, while the financial crash of the South Sea Company bubble in 1720 formed a turning point in the history of the company and British interests in Spanish America.[80] In terms of the state of cartography, the period straddles two epochs of exploration identified by geographer Joseph Conrad - between romantic piratical adventures, fantastical beasts and 'extravagant speculation' of *Geography Fabulous* in the 16th and early 17th century, and the institutionalised geography of the Royal Geographical Society (founded in 1830) and quests for precision and certainty in the 18th century Enlightenment in *Geography Militant.*[81] Between these two epochs, in the mid to

English middle class: business, society and family life in London, 1660-1730 (1989), p. 17. Zahedieh, *The capital and the colonies,* p. 17. Oxford and Edinburgh both housed small map publishing businesses

[78] Mokyr discusses the importance of standardisation of information through printing in more detail in *The enlightened economy*

[79] Zahedieh, *The capital and the colonies,* p. 138

[80] The Board of Longitude was established as a sub-group of the Admiralty in 1714 to manage the search for methods of finding longitude at sea. Sophie Waring, 'The Board of Longitude and the funding of scientific work: negotiating authority and expertise in the early nineteenth century', *Journal for Maritime Research* Vol. 16 No. 1 pp. 55-71 (2014)

[81] Joseph Conrad's essay 'Geography and Some Explorers' published in 1924 is described by Felix Driver in *Geography Militant*

late 17th century, strange animals and 'parts unknown' on maps were gradually being replaced with navigation marks indicating rocks, shallow waters, and promises that the information was the latest, the most accurate, and crucially the most useful.

The findings result from analysis of manuscript sources including mariners' inventories, accounts of the Royal Mathematical School, and documents kept by the Darien Company at the National Library of Scotland (NLS). The diaries of Captain John Narborough, recently acquired by the British Library and not previously included in historical accounts of the voyage, are analysed alongside manuscript maps made of the Straits of Magellan and diaries and drawings by privateers. Some of the best evidence about cartography is within maps themselves, and collections in libraries at the National Maritime Museum in Greenwich, the British Library, the Library of Congress in Washington D.C, and Yale Centre for Britain Art and Beinecke were used to create and analyse a database of 179 printed maps of the Americas published in London 1660-1720. Contemporary navigation and printing manuals were also used to assess skill and labour involved in making printed maps and charts, as well as an extant copper plate in the NLS and account books by publisher George Willdey in the National Archives at Kew, London.

The first section of the thesis considers demand for useful geographical knowledge from emerging maritime and mercantile interests and institutions. Chapter 1 discusses demand from mariners and the Royal Mathematical School, identifying ownerships of maps, charts and navigation instruments produced in London. Chapter 2 assesses demand from natural philosophers, the Royal Society, and civil servants Samuel Pepys and others in the Board of Trade, highlighting their stake in increasing knowledge of empire. Chapters 3, 4 and 5 are cases studies about demand for information to support new markets and trade in manufactures, silver and enslaved people in Spanish America and the Pacific. Chapter 3 assesses the voyage by John Narborough to the Straits of Magellan in 1669-1671, and Chapter 4 compares maps and observations made on buccaneer voyages in 1680s. Chapter 5 discusses geographical information used and produced by the Darien Company and the South Sea Company. The final two chapters use the map database to look at how the trade responded to demand for information, and discuss what maps of the Americas looked like. They highlight that the market was boosted by colonial demands and that for some regions, London became the European market leader for maps and charts. Chapter 6 considers the growing inclusion of useful information as well as strategies to 'sell' the colonies and assert British sovereignty through maps, whilst chapter 7 analyses print artisans' skills to identify the scope of labour and skill in drafting, engraving and printing the 179 maps. The assessment challenges historians' conclusion that English mapmakers were lazy and unskilled, and instead suggests that meeting demand for useful knowledge of empire placed significant demand on the labour and skill of print artisans in London.

The British American world 1660-1720

Basque whale traders had engaged in cross-oceanic Atlantic commercial exchange since at least 1000 but the Americas and Atlantic first came into existence as a space structured by empire, trade and global exchange in 1492 when Christopher Columbus sailed from Spanish port Palos across the North Atlantic Ocean via the Canary Islands, reaching the Bahamas and Hispaniola. This and subsequent voyages established the foundations for colonising voyages and commercial exchange from Spain and Portugal to the Americas. The Treaty of Tordesillas (1494) gave legalistic weight to geographical divisions, establishing the principle that all territory east of the line of demarcation was Portuguese, all territory west was Spanish.[82] By 1580 there were around 225 towns with an Hispanic population of roughly 150,000, stretching from Guadalajara in the north (1548) to Chile (1565) in the south.[83] Over the course of 16th and 17th centuries more European nations joined the Atlantic trade system, particularly Dutch, French and Portuguese, expanding the application of mercantilist political economy to overseas trade. Dutch involvement through the Dutch West India Company (WIC) focussed largely on trade, with less emphasis on creating settlements. Portuguese and French traders accelerated their activities on the West African coast, particular in Guinea and Mina and the Gold Coast, although the WIC challenged Portuguese dominance in Guinea from the 1590s to become the established power by the 1630s.[84] In the early 17th-century, the Dutch and Portuguese remained the main traders, but the balance of power and economic returns was changing.

Britain was a latecomer to Atlantic trade. From the 1560s intermittent and privately-financed voyages traded in enslaved people in Guinea, but with 'trifling' contribution to England's economy.[85] Ships leaving Dover in 1583 and 1606 settled Newfoundland and Jamestown in Virginia, Barbados in 1627 and conquered Jamaica in 1655, enabling British merchants and settlers to exploited the raw materials tobacco, sugar and others, and abundant land. By 1660 England had around 140,000 subjects settled in three regions, and by 1700 controlled 17 colonies in North American and the Caribbean, in contrast to France's eight and the Dutch Republic's three.[86] The British American world evolved into three overlapping geographical spheres of activity. By far the most lucrative, expansive and ultimately world-shaping trade developed in the triangular slave trade. In 1660 the Company of Royal Adventurers was established in England and granted a monopoly, into which the Royal African Company (RAC) was re-incorporated in 1672.[87] Ships sailed southwards from England with cargoes to exchange for wine, African redwood, enslaved people and other commodities in Madeira and in West African ports Ouidah, Calebar, Gambia and Ardra, then crossed the Atlantic ocean to reach ports in the

[82] The line was a meridian 370 leagues, or 1185 miles, west of the Cape Verde Islands
[83] Elliot, *Empires of the Atlantic World,* pp. 41, 124
[84] P.E.H Heir and Robin Law, 'The English in West Africa to 1700' in *The Oxford history of the British Empire: the origins of empire* (Oxford, 1998), pp. 249-50
[85] Ibid, pp. 245-248
[86] Zahedieh, *The capital and the colonies*, p. 32
[87] K.G Davies, *The Royal African Company* (1957)

Caribbean and North America. In 1661-1665, 7338 enslaved people were forcibly transported on British ships to the Caribbean, and by 1716-1720 this had grown to 28119, an increase of almost 400% and vastly outstripping French, Dutch and Portuguese trade.[88] In the same period, 30,661 people were transported to North America (New York, Maryland, Virginia and South Carolina), bringing the total number of enslaved people transported between 1660 and 1720 to 389,002.[89] White indentured servants were replaced with enslaved people in order to service growing industries and demand, spurring growth in the slave trade, and transforming places like Bridgetown in Barbados and Port Royal in Jamaica from villages into colonial hubs largely born from immense human suffering.[90] A second sphere of trade was in furs, whale and other commodities from Newfoundland and areas of Nova Scotia traded across the North Atlantic to Britain. In 1667 Nova Scotia was claimed as French territory, but Newfoundland fishing continued to flourish and in 1670 the Hudson's Bay Company was established to expand fur trade. A third geographical trading sphere began to develop from the 1660s with voyages to the south Atlantic and Straits of Magellan in search of a convenient passage to the Pacific ocean.

This expansion of trade transformed many of the colonies, as land and natural resources were devoted to producing raw materials for export. By 1700 the English re-export market was worth almost a third of the total value of English exports, whilst the value of plantation imports rose by around 100% between 1663 and 1701 and exports around 150%.[91] Infrastructure and institutions in London adapted as the city grew to be the major urban centre of Europe with a population of half a million.[92] It housed between 600 and 1000 full-time merchants operating in Atlantic trade and serviced around 2000 ships a year including 350 from the colonies.[93] Publishers and map makers benefitted from the growth of the city, making and selling their goods from dockside in Wapping and from Westminster Hall and the Exchange in the City.[94] As will be discussed, their role in producing images and texts of the Americas helped to prepare London and England's economy for industrialisation whilst their labour and skills were boosted and put to the test by the demands of new and distant geographies.

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[88] The changes in volume of trade in enslaved people by British trades between 1660 and 1720 was also concurrent with changes in organisation of the trade which experienced a breakdown of official monopoly by the Royal African Company between 1673 and 1688 and subsequent 'licensed freedom' of trade. The impact of changing organisation of the trade on price and efficiency is the subject of scholarly debate. Nuala Zahedieh, 'Monopoly and freed trade. Changes in the organisation of the British Slave Trade, 1660-1720' in F. Datini, *Proceedings of the Instituto Internazionale di Storia Economica* (2014), pp. 651-662; K.G Davies, *The Royal African Company*; William A. Pettigrew, 'Free to enslave: politics and the escalation of Britain's Transatlantic Slave Trade, 1688-1714' *WMQ* 64 (2007), pp. 3-38

[89] Just 7.8% landed in North America, and by 1700, over 80% of people transported on the Trans-Atlantic route to English America had landed in Barbados or Jamaica. David Eltis, 'The British transatlantic slave trade before 1714: annual estimates of volume and direction' in Robert I. Paquette and Stanley L. Engerman eds., *The Lesser Antilles in the age of European expansion* (Gainesville, Fla., 1996), pp. 182-205

[90] Hilary McD Beckles and Andrew Downes, 'The economics of transition to the black labor system in Barbados, 1630-1680' *The Journal of Interdisciplinary History* Vol. 18 No.2 (1987), pp. 225-247

[91] Zahedieh, *The capital and the colonies,* p. 28

[92] For discussion of the growth of London see A.L. Beier and Roger Finlay eds., *London 1500-1700: the making of the metropolis* (1986); Paul Griffiths and Mark S.R Jenner eds., *Londinopolis: essays in the cultural and social history of early modern London* (Manchester, 2000); Henry Rosaveare, "The Damned Combination": the port of London and the wharfingers' cartel of 1695', *London Journal*, 21 (1996); Peter Whitfield, *London: a life in maps*, (2006)

[93] Earle, *Making of the English middle class*, p. 24; Zahedieh, *The capital and the colonies*, p. 166

[94] Tyacke mapped the shop addresses of London map sellers to show a concentration in the City but growing presence of chart makers in maritime London. Tyacke, *London map-sellers*

Chapter 1: Maritime demand for useful knowledge

In 1701 a captain died off the coast of Guinea. Mariner Nathaniel Uring recorded that the crew consulted a sea chart, then successfully continued the voyage. On another voyage in 1707 Uring took charge on a ship sailing to Jamaica despite never having visited the island – 'I knew the island by my longitude and latitude, and I shaped my course accordingly', he claimed.[1] About fifty years earlier, en route to Barbados, Richard Ligon observed mariners using compasses, log-lines and a back-staff to record the ship's route. Their maps and instruments had travelled from London and were brought out onto deck to mark their position or make observations of the skies, sea or land. They were as central to the voyage as the men who rigged the sails or kept watch. They were also cheap - a compass or chart could cost 1s and a log-line about 4d - and easily purchasable by mariners.[2] Once Ligon arrived in Barbados he persuaded a captain to hand over his maps, and reported that the island was 292 square miles.[3] His notations were repeated, scrutinised and corrected in 1666 in the pages of the Royal Society journal *Philosophical Transactions* and by President of the Royal Society Hans Sloane in 1707. This dialogue between a curious early observer of American geography and later experimenters and colonialists reveals how scientific interest in the colonies demanded practical knowledge and skills. From another British colony, a draft map and a derrotero (sea chart) arrived in London in 1671 on a ship sent by Governor Thomas Lynch of Jamaica to state officials Lord Arlington and Robert Murray.[4] The Governor had been asked to send geographical information to the Committee Relating to Trade and Plantations about the young colony to help them manage its development. Lynch claimed the map was 'more exact than was ever made', and later that year London map-maker Joseph Moxon used the information to publish *A new and accurate description of Jamaica.*[5] It could be bought for 6d.[6] These three incidents indicate cases of maritime, 'scientific' and state uses of geographical objects produced in London, highlighting how the desire to expand and exploit early British empire in the Americas fed into a market for useful knowledge, objects and skills.

This chapter is the first of two that consider the impact of growing Atlantic and Pacific trade and settlement on the market for useful geographical knowledge in London. It assesses arguments that conspicuous consumption by middling sorts was the main source of demand for maps and charts and suggests that, in the case of England, the evidence to back up this claim is weak. Instead, it suggests that the expansion of American trade in parallel with a scientific environment that favoured Baconian empiricism and experiment also explain demand for geographical knowledge, and that, far from being marginal to navigation and scientific practices, objects such as maps, charts and navigation instruments were crucial in the expanding colonial enterprise. It argues that the London trade's capacity to meet this demand suggests the presence of a skilled print artisanal

[1] Nathaniel Uring, *A history of the voyages and travels of Capt. Nathaniel Uring. With a new draught of the bay of Honduras* (1725), pp. 31, 242
[2] See pp. 28, 35, 41, 50 for sample costs of instruments and charts
[3] Richard Ligon, *A true and exact history of the island of Barbados* (1657), p. 26
[4] Calendar of State Papers, Colonial Papers, Vol. XXVII, Nos. 22, 22, I, II, III, National Archives, Kew
[5] Joseph Moxon, *Novissima et accuratissima descriptio Jamaica* (1671)
[6] *Term Catalogues*, Vol 1. (1668-1682)

community that was further stimulated by an imperial complex that required practical, useful, hands-on knowledge and skills. This analysis also highlights that colonial commerce and empire were not isolated from science and experiment. Instead, they overlapped in ambition and in activities, and, in many cases, individuals re-appeared in multiple capacities. This chapter analyses mariners' inventories and ship accounts to suggest that the specific challenges of Atlantic and Pacific navigation created maritime demand for information and skills. It considers the founding of the Royal Mathematical School (RMS) in 1673 in London, and the geographical objects purchased to teach the 'mathemats'. It highlights that the School believed it could supply its needs largely from the English trade in geographical information and objects. The chapter extends Alexi Baker's analysis of the RMS back to its founding in 1673, and assesses their account books to augment Baker's analysis by adding evidence of purchases of maps and books.[7]

Unlike East India trade which benefitted from the organisational capacity of chartered companies in producing geographical information, the atomised and largely private nature of Atlantic and Pacific trade meant that there was no mercantile institution managing the collection and distribution of knowledge.[8] Furthermore, whereas other European imperial centres such as France or Spain used the *Académie des Sciences* and the *Casa de la Contratación* to manage the production and circulation of geographical information, England notably lacked a central repository for geographical knowledge. The map and chart trade was commercial, dominated by small artisans and publishers governed largely by market conditions. There is scant evidence or insight into their business practices, although some clues are available in advertisements in *Term Catalogues,* newspapers or trade cards. Although map makers like John Seller and Herman Moll claimed institutional patronage of the Royal Society or the Crown with titles like *Geographer Royal* or *Hydrographer Royal*, these arrangements were largely symbolic. The upshot of the commercial nature of the map trade was that makers and publishers relied largely on consumer demand, and were therefore responsive to the demands and tastes of the market.[9] Another difficulty in finding concrete evidence, particularly on an individual level, is the ephemeral nature of maps and charts, and to an extent, quotidian navigation instruments like compasses and log-lines. Extant maps are likely to have been the beautiful framed objects kept in collections, whereas mariners' charts were cheap and ordinary, easily rotted, torn or lost at sea. However fragments suggest that behind these hints there existed a much more substantial trade. The Royal Mathematical School, the Royal Society and the Board of Trade kept financial records and diaries or the Royal Society journal *Philosophical Transactions* provide some evidence of demand.

[7] Alexi Baker, '"This ingenious business': the socio-economics of the scientific instrument trade in London, 1700-1750', Unpublished PhD thesis, University of Oxford 2010

[8] Maxine Berg, Georgio Riello and Prasannan Parthasarathi discussed the importance of India in useful knowledge production. Maxine Berg, 'Useful knowledge, 'industrial enlightenment', and the place of India' *Journal of Global History,* 8, 1 (2013), pp. 117-141; Giorgio Riello, 'Asian knowledge and the development of calico printing in Europe in the seventeenth and eighteenth centuries' *Journal of Global History,* 5, 1, 2010, pp. 1–28; Prasannan Parthasarathi, *Why Europe grew rich and Asia did not: global economic divergence, 1600-1850* (Cambridge, 2011)

[9] See chapter 6

Maps and Conspicuous Consumption

Historians acknowledge that the English map trade expanded significantly in the late-17th century.[10] Helen Wallis claims that 'maps were published in great profusion' and Sarah Tyacke documented the increase of map sellers in London.[11] This expansion is usually explained by the 'demands of an expanding middle class' and the concurrent rise in conspicuous consumption.[12] J.B Harley identified that the subscribers to John Senex's *A new general atlas* were from 'groups in whose hands economic and political power was concentrated', but he acknowledged that 'readership was growing for maps from the rising commercial and craft groups'.[13] Increase in access to capital, rise in wages, ongoing urbanisation and changing social norms meant that increased numbers of middling sorts were able to buy household items.[14] Books, prints and pictures was part of this consumption and, according to historians, public display of large and beautiful maps could assert social-economic status.

Lorna Weatherill found that in a sample of 2,902 probate inventories in England between 1675 and 1725 book ownership increased from 18% to 22% and pictures from 7% to 21%.[15] In the London Orphans' Court inventories, book ownership increased from 60% to 94% and pictures from 44% to 76% in the same period.[16] Peter Earle made similar findings, writing that 'another feature of middling houses was the huge increase in pictures, ornaments and bits and pieces […] By the 1690s and the early 18th century, many people had huge collections'.[17] Mercer Daniel Thomas (d.1704) owned '740 books, three telescopes, a globe, several maps, a sailing compass […] In other rooms he had another 150 books and atlases […] more maps', exemplifying how mercantile affairs could intersect with consumption of geographical objects to publicly assert social prestige.[18] Maps were also displayed in colonial North American houses, and Margaret Pritchard discusses how 'maps were often specified for the hall, which was generally the most important and visible space […] Large maps prominently displayed exhibited their owner's awareness of and interest in an expanded

[10] Helen Wallis, 'Geographie is better than divinitie: maps, globes and geography in the days of Samuel Pepys' in Norman J. W. Thrower ed., *The compleat plattmaker: essays on chart, map and globe making in England in the 17th and 18th Centuries* (1978), pp. 1-42, p. 3
[11] Helen Wallis, 'Navigators and mathematical practitioners in Samuel Pepys day' *The Journal of Navigation* Vol. 47 (1994) pp. 1-19, p. 2; Sarah Tyacke, *London map-sellers 1660-1720: a collection of advertisements for maps placed in the 'London Gazette' 1668-1719, with biographical notes on the map-sellers* (Tring, 1978)
[12] Helen Wallis, 'Geographie', p. 3. Catherine Delano-Smith analysed probate inventories from the mid-16th century to identify map ownership for education purposes in university towns Oxford and Cambridge. Catherine Delano-Smith, 'Map ownership in sixteenth-century Cambridge: the evidence of probate inventories' *Imago Mundi,* Vol.47 (1995), pp. 67-93. Classifications of 'middling sorts' vary but Lorna Weatherill considers the middle ranks to 'encompass people who were neither at the bottom (servants, labourers, and wage-earners) nor at the top (county gentry and aristocracy)' and therefore she includes 'lesser gentry, professions, merchants, shopkeepers, farmers, yeomen, husbandmen, and craftsmen', which includes about half the households in England, 700,000 out of 1,400,000. Lorna Weatherhill, *Consumer behaviour and material culture in Britain 1660-1760,* (1988), p. 14
[13] J.B Harley, *The new nature of maps : essays in the history of cartography* (Baltimore, 2001) pp. 119, 123
[14] Maxine Berg and Helen Clifford eds., *Consumers and luxury: consumer culture in Europe, 1650-1850* (1999)
[15] Weatherill, *Consumer behaviour,* p. 26. She notes that book titles were usually not recorded, and that pictures were usually either portraits or landscapes. She does not mention any maps or that she included maps under a definition group of 'pictures'.
[16] Ibid, p. 27. Weatherill notes that the London Orphans' Court inventories include a wealthier group of individuals, including some wealthy merchants. The median value of the inventories sample was £2, 034, compared to £63 in the probate sample
[17] Peter Earle, *The making of the English middle class: business, society and family life in London, 1660-1730* (1989), p. 295
[18] Ibid, p. 296

worldview'.[19] These were often decorative and expensive items, for example a globe purchased by John Curtis cost £6.12s in 1698. Chimney-breasts were used to display pictures, and Abbot Lowell Cummings notes that in some houses 'the overmantel panel itself was made the ground for a landscape painting directly upon the woodwork'.[20] This practice is highlighted in the inventory (1770) of Virginia Governor Lord Botetourt's estate, which listed 'map of N and S America' in same entry as hearth equipment.[21] Merchant William Bastard in Cornwall placed one framed map over the chimney in his 'best chamber' and another in the hallway, whilst Richard Neville, a gentleman, displayed two maps next to pictures in his staircase.[22]

However although there was increased ownership of books and pictures, the evidence for a significant increase in ownership of maps and charts by aspiring middling sorts is less certain.[23] Lorna Weatherhill recorded book ownership in Orphans' Court inventories; however an analysis of map ownership in 60 inventories shows that just one contained a map, owned by haberdasher Richard Eardley who kept it 'in the dyning room'.[24] Muted increase in map ownership by middling sorts is also shown in a range of inventories from gentleman to yeoman and mariner in Cornwall, Berkshire and Kent between 1600 and 1750. In Mark Overton's analysis of the household belongings of 12,000 individuals, just 63 or 0.5% owned maps.[25] As figure 1 demonstrates, ownership did increase between 1600 and 1750. Between 1600 and 1650, just eight individuals owned maps, six of which were gentlemen. Between 1650 and 1700, this increased to 18, by a wider range of professions, including three clerks, a milton and a mariner. In the next 50 years, ownership of maps remained static with 18 individuals owning maps, but the range of professions broadened to include gardener, fisherman and pedler.

[19] Margaret Pritchard, "'*Useful and elegant furniture for screens, halls, large rooms, stair cases*": maps as symbolic objects' pp. 43-53 in *Degrees of latitude: mapping colonial America* (New York, 2002), p. 49

[20] Abott Lowell Cummings ed., *Rural household inventories: establishing the names, uses and furnishings of rooms in colonial New England homes, 1675-1775* (1964), p. *xxxvi*

[21] Graham Hood, *The governor's palace in Williamsburg: a cultural study* (Williamsburg, Va., 1991) p. 289

[22] Mark Overton, J. Whittle, D. Dean and A. Hann, *Production and consumption in English households, 1600-1750* (2004). Berkshire inventories in J. Wooders, 'Local economies and patterns of consumption: contrasting trends in early modern Berkshire 1650-1750' Unpublished PhD thesis, University of Reading, 2011. I am grateful to Professor Mark Overton for sharing the details of the inventories

[23] Stephen Hague also did not identify maps as a feature in status display in gentlemen's houses in the British Atlantic in this period. Stephen Hague, *The Gentleman's house in the British Atlantic World 1680-1780* (New York, 2015)

[24] Orphans Court inventories were produced upon the death of the parents of a child in London aged under 14, at which point the child was taken into the care of the State and an inventory drawn up to assess the wealth of the estate the child inherited. They provide useful insight into the wealth and consumption patterns of middling sorts such as stationers, clockmakers and shipwrights as well as wealthier merchants. Although it could be argued that due to the low value of maps and charts, they would not be recorded in an inventory, the recording of books, prints and other items of similar cost to maps and charts (as well as the inclusion of maps in Richard Eardley's inventory) suggests that maps were not so insignificant that they would not be recorded. Inventory of Richard Eardley, haberdasher. Orphans Court inventory 0276, London Metropolitan Archive

[25] Overton, Whittle, Dean, and Hann, *Production and consumption,* and the Berkshire inventories in J. Wooders, 'Local economies and patterns of consumption'. Although it may be argued that the relatively low price (1-2s) of uncoloured printed maps made them unlikely to appear on inventories, the recording of some items including maps of the value of 1s on both the inventories from Kent, Berkshire, and Cornwall, as well as the Orphans' Court inventories suggests that it was not a completely unknown practice

Figure 2: Map ownership by profession in Kent, Berkshire, and Cornwall, 1600-1750

	Profession	**Number of inventories with maps**
1660-1650	Gentleman	6
	Yeoman	2
		Total: 8
1650-1700	Gentleman	11
	Clerk	3
	Yeoman	1
	Milton	1
	Mariner	1
	Cordwainer	1
		Total: 18
1700-1750	Gentleman	1
	Yeoman	6
	Merchant	2
	Mercer	1
	Pedler	1
	Gardener	1
	Baker	1
	Miller	1
	Cooper	1
	Schoolmaster	1
	Chandler	1
	Fisherman	1
		Total: 18

Figure 2: Sample of valuations of maps in probate inventories in Cornwall, Berkshire and Kent 1600-1750

Date	Type of map	Value
1627	1 map	10s
1662	3 'great paper maps'	£1
1671	1 map	£1.10s
1675	4 'small' maps	1s
1681	1 'great' map	£1
1692	1 'large paper map'	13s.4d
1692	8 maps	£4.3s
1711	1 map	13s.6d
1721	5 maps	£12.6s
1737	2 maps	1s.2d

There is some evidence that merchants involved in American trade owned maps for display. Stephen Lawrence in Cornwall owned ¼ of a ship and ¼ of a cargo, including 6 casks of brown sugar, valued at £65, suggesting he was involved in long-distance trade, most probably to the Caribbean. He hung five maps in his parlour, valued at £12.6s, or over £2 each, which was very expensive for printed maps (single sheet maps often cost 1-2s), so it is probable that they were large and with colour, and probably framed. Although the increased map ownership by a broadening range of social professions supports traditional interpretations, the scope of demand from these groups was marginal and unlikely to have supported any significant expansion of the trade. Overton's inventories focus on three rural counties outside of metropolitan London where consumers had higher disposable incomes, but they remain a useful indicator of trends. Although a small sample, the scarcity of map ownership in the inventories by both middling sorts and by wealthier commercial elites indicates that domestic demand was unlikely to have been the largest driver of expansion of trade in geographical objects in England.

Part of the reason for historians' belief in the power of conspicuous consumption of maps are the practices of display in Dutch households. Svetlana Alpers discusses 17th century Dutch paintings *The art of painting* and *Solider* and *Young girl smiling* both by Johan Vermeer and *The musicians* by Jacob Ochtervelt, which prominently include maps as wall hangings, suggesting that maps were habitual components of domestic spaces, rather than circumstantial details.[26] Alpers also implies that Dutch artists had close connection to maps making.

[26] Svetlana Alpers, 'The mapping impulse in Dutch art' in David Woodward ed., *Art and cartography: six historical essays* (Chicago, 1987) pp. 55-57

However, complementary images do not appear on the same scale in English portraits of domestic settings. English map-making and art was not only muted by the lack of rivals to the Dutch 'Greats', but was also organised differently, with map-makers and sellers more closely allied to the book and prints trade than portraiture. In the Netherlands an artist may have wished to advertise his or her maps through paintings, or had a greater inclination to portray them as they were a greater part of artists' domestic and cultural milieu. Maps were also artistic devices used to situate the social position of, for instance, a merchant's wife or household. Considering the longer history of prestigious and decorative map production in the Netherlands, map display was probably a more established and powerful social norm, employed to display status and wealth. In England, where map development had been later and less prestigious, it may have held a lesser place in social practice at this time. In short, historians should be cautious about conflating Dutch social norms and practices with European and presumptions that the middling sorts were solely responsible for growth in the map trade. Finally instead of producing increasingly decorative and aesthetically-pleasing maps, publishers focussed on maps that emphasised accuracy and utility, suggesting they were responding to another sort of demand.[27] Historian David A. Woodward recognised that the post-Restoration age of commerce and Royal Society involved economic, political and intellectual changes that meant that 'demand for practical devices, including maps, expanded'.[28] The following discussion expands on these other sources of demand.

Maritime demand and the Royal Mathematical School

In 1663 English mariner Edward Barlow sailed from England to Brazil with a license to trade goods with Portuguese merchants. The ship loaded wine at the Madeira islands, before sailing south-east. The winds were 'seldom or never known' at 25° north, until 7° north of the equator where the ship saw 'continual rains, with thundering and lightening, and many times strong gusts of winds'.[29] When the ship reached the equator - or 'middle part of the world' – the ship continued to set the course south until they reached 23° south at which point they sailed due west to reach Brazil. Most European ships crossed the Atlantic in this way, using trade winds to carry them westwards. Barlow's voyage from Madeira to Rio de Janeiro took eleven weeks.[30] Richard Ligon's voyage in 1647 from England to Barbados sailed from the downs to Falmouth, taking a course southwest, until they reached 45° north (around Aquitaine in France), from here they sailed to Madeira. Barlow writes that they found a trade-wind to carry them southwards, until they reached the islands Bona Vista, May and Palma. Next they sailed to Cape Verde islands, a common stop-off for ships sailing west, then continued to St Jago in Cape Verde to trade in enslaved people, horses and cattle, which they planned to sell in Barbados.

[27] This is discussed in Chapter 6
[28] David A. Woodward, 'English cartography, 1650-1750: a summary' in Norman J. Thrower ed., *The compleat plattmaker: essays on chart, map, and globe making in England in the seventeenth and eighteenth centuries* (Berkeley, 1978) pp. 159-193
[29] Journal of Edward Barlow 1659-1703, JOD/4 National Maritime Museum, p. 82
[30] Barlow's voyage to Rio de Janeiro took him further south than most British voyages to the Caribbean or North America, however the navigation principles and main European and African ports of call were the same

In June 1668 Captain Zachariah Gillam sailed from the Thames, reaching the Orkney Islands on 14 June.[31] The ships set a course west and, sailing south of the southern tip of Greenland, reached Resolution Island in Hudson's Strait about eight weeks later.[32] The ships wintered at the Rupert River and returned the following year. These three ships used routes, ports and geographical features that formed the fault lines of European colonial trade to the Americas, with perhaps as many as 20,000 voyages by British merchant ships following these same patterns between 1660 and 1720.[33]

Maritime demand is an obvious starting point for analysis of the map and chart trade in England. Maritime capacity was essential to support the expanding and consolidating British empire. However, historians have tended to argue that maritime need for knowledge was supplied from Dutch or other European sources. Others have identified the growth of this knowledge in England but neglected the economic and imperial context. More recently, historians of science focusing on the importance of tacit or informal knowledge have argue that maps and charts did not have maritime utility. This discussion instead suggests that mariners did need geographical objects and skills to navigate and that they bought at least some of these from London traders whose business was boosted by demand for useful knowledge to support and improve trans-oceanic and coastal navigation in British Atlantic and Pacific trade. Mariners' inventories, ship accounts, and diaries, including by Nathaniel Uring, John Taylor and Edward Barlow, provide insights into mariners' training, use of maps and instruments, and navigation knowledge. Account books for the Royal Mathematical School demonstrate institutional demand for maps, charts, instruments, and books purchased from a range of sellers in London to give pupils practical education in navigation in order to improve the nation's maritime capacities. The decision by the Royal Mathematical School to purchase these items indicates their centrality to navigation training and practice, and suggests that the London trade was of sufficient quality to meet the needs of the School. It seems probable therefore that it could supply demand from ordinary mariners and navigators. The purpose of this is not to engage in a nationalistic celebration of English maritime abilities, but instead to highlight the developing features of London's knowledge economy, in this case in geographical knowledge and skills spurred by commerce and empire, which in the long-run, feature in the story of England's industrial revolution.

Long-distance trade posed a unique challenge to established methods of navigation in early modern Europe.[34] When trade was limited to nearby coasts, merchant ships navigated short distances with short journey

[31] 'A breviate of Captain Zachariah Gillam's journal to the North West in the Non-Such Catch in 1668' in John Seller, *The English Pilot: the fourth book* (1689)
[32] Gillam's voyage was part of attempts to establish the viability of fur trade from Newfoundland. In 1670 the Hudson's Bay Company was founded. Ted Binnema, *Enlightened zeal: the Hudson's Bay Company and scientific networks, 1670-1870* (Toronto, 2014)
[33] Ralph Davis estimated that in 1686, 335 ships left London for British plantation trade, which represented between 70 and 75% of England's plantation trade. The annual total for the UK was probably therefore closer to 450. Factoring in the lower annual departures in early years 1660-c.1680, and disruption to merchant shipping caused by 26 years of conflict, 20,000 voyages in a period of 60 years is an appropriate, albeit higher-end estimate. Ralph Davis, 'English foreign trade, 1660-1700' *EHR,* Vol. 7, No. 2 (1954), pp. 150-166
[34] For histories of navigation practice see E.G.R Taylor, *The haven-finding art: a history of navigation from Odysseus to Captain Cook* (1971); Rebekah Higgitt, Richard Dunn, Peter Jones eds., *Navigational enterprises in Europe and its empires, 1730-1850* (Basingstoke, 2015)

times and almost always with a coastline in sight.[35] Centuries of trade within these borders built up collective knowledge that mariners drew on to negotiate difficult channels, tricky tides or unusual weather patterns. Long-distance trade to the Americas challenged this tradition, confronting mariners and captains with unfamiliar trade routes and weather conditions, and turning some journeys into months instead of weeks or days. A voyage to Jamaica from London could take around ten weeks, eight weeks to Barbados, and sailing to New England took around six weeks.[36] Author and gentlemen philosopher Hans Sloane warned about the difficulties of navigation of the Caribbean sea following his voyage to the Caribbean in 1687: 'we went due West for Barbados, which is the way not to miss it, because Sailers being sure of the Latitude by Observation they keep in it least they should run by the island, which being very low Land, and so consequently not visible far off at Sea, may be easily overrun by unwary Seamen'.[37] Voyages to the South Atlantic and the Pacific coast of Spanish America, including via the Panama Isthmus, were even less frequent in 1660-1720, and English navigators in this region had substantially less experience of the geography of the region. Mariners could be away at sea for over a year. Not all voyages to the South Seas even made it, as in the case of Edmund Halley on the *Paramore* in 1698-1701.[38] Although by 1700, English mariners had been sailing to the American and Caribbean colonies for between 93 years (Virginia) and 37 years (Carolina), voyage times had remained static and disaster could still strike. The proliferation of shipwreck narratives in the long 18th century was testimony to the deep-seated and realistic fear of spending life's final moments in a cold dark sea.[39]

Weather and sea conditions also differed considerably.[40] When sailing to Barbados in 1647, Richard Ligon described missing their destination: 'we […] were somewhat retarded in our passage […] for in the time of tornado, the clouds interpose so thick, and darken the sky, so much as we are not able to make any observation for a fortnight together'.[41] Hurricanes could ruin cargoes, destroy a ship outright, or seriously delay a ship's schedule – a serious matter when ships carried valuable commodities that merchants were expecting to sell according to the established trade cycle.[42] Arriving 'late' at a Caribbean port could mean securing much less favourable rates as market saturation may suppress demand.[43] Fierce winds blew in New England and the

[35] David W. Waters, *The art of navigation in England in Elizabethan and early Stuart times* (1958), pp. 14-15
[36] I.K Steele, *The English Atlantic, 1675-1740: an exploration of communication and community* (Oxford, 1986)
[37] Hans Sloane, *A voyage to the islands of Madera, Barbados, Nieves, St Christophers and Jamaica* (1707), p. 30
[38] Edmund Halley attempted a voyage to the Pacific via the South Atlantic in 1698-1701. The ship turned back to England apparently due to insubordination, rather than a lack of geographical knowledge; however the case highlights the difficulties in managing a long voyage in unfamiliar territory
[39] Amy Mitchell-Cook, *Shipwreck and survival in Early America* (Columbia, 2013). Mitchell-Cook analysed 100 narratives of shipwrecks from the 1660s to 1840s. Unfortunately her focus on literary narratives means that explanations of where, how and when shipwrecks occurred are absent. William J. McCarthy argues that shipwreck was a central political, economic, social and cultural feature of early modern life in Europe. William J. McCarthy, 'Gambling on empire: the economic role of shipwreck in the age of Discovery', *International Journal of Maritime History*, XXIII (2011), 69-84
[40] Stuart B. Schartz, *Sea of storms: a history of hurricanes in the Greater Caribbean from Columbus to Katrina* (Princeton, 2015)
[41] Ligon, *Voyages*, p. 19
[42] Although two voyages per year were temporally possible from London to the Caribbean and North America, the demands of the crop season made one voyage the more common practice. For sugar trade in Barbados, ships left London in October-December to arrive between February and May when new sugar was available in the dry season. It also allowed them to leave before the Summer months when hot and humid weather spread disease. In the Chesapeake, ships aimed to arrive in early November in time for tobacco cargoes that had been cut in mid-September and cured from September onwards. Nuala Zahedieh, *The capital and the colonies. London and the Atlantic economy, 1660-1700* (Cambridge, 2010), pp. 140-142
[43] Gregory O'Malley, *Final passages: the intercolonial slave trade of British America, 1619-1807* (Chapel Hill, 2014)

Chesapeake.[44] Indeed ships trading from New England ports were advised to avoid arriving in mid-winter in favour of April and November.[45] In March 1699 surveyor general Edward Randolph wrote from Charlestown to the Council of Trade and Plantations that 'Charles Town Bay is the safest port for all vessels coming through the Gulf of Florida, in distress, bound from the West Indies to the Northern Plantations; if they miss this place they may perish at sea for want of relief, and having beat upon the coast of N. England, New York or Virginia by a North West wind in the winter'.[46] Further south, in latitudes around 49° and in Tierra del Fuego, navigators faced severe cold, snow and ice in May to November, which often required ships to seek refuge before a voyage could resume in the spring.[47] Although English traders in the Northern Baltic trade would have faced similar winter conditions, its proximity to England meant that ships did not have to take months out of their schedule to negotiate the weather, and if disaster did strike, ships and their cargoes were not thousands of kilometers away from friendly ports or other ships. Collecting and using information about these geographical conditions was a crucial part of supporting expanding trade to these regions.

Protection of life was not the only (or indeed, the main) motivation behind improving navigation and geographical knowledge of the America. Ship-owners and merchants had financial interest in ensuring a ship's safe passage. The ships alone could cost thousands of pounds. Gregory King suggested that the average West India trade would cost £1, 980 and £3, 480 to build a tobacco ship, and Zahedieh calculated that in 1686 the capital cost of London's plantation fleet was £780,000.[48] The majority of colonial ships were owned in partnerships, which lowered the risk to the individual, however the cost of investing in shipping remained high, suggesting high incentive on the part of owners to try to ensure that poor geographical or navigation knowledge was not the cause of shipwreck or damage. Cargoes were also extremely valuable. Although this may not have translated directly into demand for geographical objects, merchants and ship-owners may have created an expectation that captains demonstrate possession of the most up-to-date knowledge or instruments evidenced by owning maps and instruments.

Maritime Demand for Maps and Charts

Finding a safe and accurate route was the priority of a navigator. Understanding the relationship between geographical features as fixed positions and the ship as a changing position was the key dynamic of navigation. It required knowing the position of the ship, the location of the land and sea, and position of the many threats to the ship like rocks and shallow water. In coastal sailing, a navigator used sight of landmarks and coastline to determine ship's position, whereas oceanic navigation required celestial observation using instruments or setting

[44] Christopher L. Pastore, *Between land and sea: the Atlantic coast and the transformation of New England* (Cambridge, Mass., 2014)
[45] Zahedieh, *The capital and the colonies,* p. 144
[46] Edward Randolph to Council of Trade and Plantations. Calendar of State Papers, Colonial Papers, Vol. 17, March 19th 1699. He advised ships that missed Charlestown to continue to Barbados which was less windy
[47] Although traders in the Northern Baltic also faced icy winters, the combination of severe weather with geographic isolation in the South Atlantic seemed to have presented mariners with additional difficulties
[48] Zahedieh, *The capital and the colonies,* p. 146

a course by dead reckoning. English map and instrument seller John Seller distinguished between the two forms, writing

> First, that which may be called the Domestick, or more common Navigation, I mean coasting or sailing along the shoare. This imploys the Mariners compass and Lead as the chief instruments. Secondly, that which may more properly bear the Name and principally to be entitled the Art of Navigation, is that part thereof which guides the ship in her course through the Immense Ocean.[49]

Maps and charts helped a navigator to manage this dynamic. Technically a map contains topographical geographical information – put simply, information about land – whilst a chart contains information about water. However maps and charts printed in the 17th and early 18th century often contained a mixture of both topographical and nautical information, although charts in sea atlases such as Seller's *English Pilot* were indeed largely nautical. Navigators used maps and charts for broadly three purposes. The first was to plot and record a ship's individual course from origin to destination. This was probably used in the long passage east and west across the Atlantic, when navigators used celestial observations to set a dead reckoning course and record the ship's progress.[50] The second use was to assess the position of land, islands, coastlines – for example the geographical position of Portsmouth relative to Madera to Guinea to Bridgetown to Charlestown. The third purpose was to alert the user to natural features that would aid or impede navigation. This included features such as rocks, sand banks or shallow waters that would threaten the integrity of a ship, or the position of bays, inlets and coves. Trade winds were also increasingly marked on charts. Some historians have been skeptical about the extent to which navigators used maps and charts, suggesting that they were too inaccurate or insufficiently detailed. However evidence of ownership of maps and charts in mariners' inventories, of purchases of maps and charts for ships sailing to Darien for the Company of Scotland, and references to use of maps and charts by John Narborough in his voyage to Magellan in 1669 all suggest that maps and charts did play a role in navigation during this period. These findings show that mariners owned both English and Dutch charts or atlases, suggesting that navigators compared and synthesised information to find the best results for their voyage. The practices suggested by ownership of these maps and in the teaching of navigation using maps and charts by the RMS suggest that mariners had practical need to use these objects, and that they played a role in stimulating supply in the London trade.

Inventories show evidence of mariners owning maps and charts. John Friscoe (d.1680 in Virginia), master of the *Jonathon of Topsham,* owned one 'old Dutch card' and one 'English seawaggoner'.[51] The description of the Dutch card (chart) as 'old' suggests that it may have been bought a number of years earlier, perhaps to be later replaced by the English 'seawaggoner' (sea atlas). The English atlas may have been John Seller's *Atlas*

[49] John Seller, *Practical navigation or an introduction to the whole art* (1680)
[50] Dead reckoning was a method of sailing that calculated the course of a ship by measuring speed and distance between two fixed points. A course determined only using dead reckoning would not use astronomical observations to ascertain the position of the ship
[51] Probate inventories from York County Estate, Williamsburg, Virginia, Colonial Williamsburg Foundation

Maritimus (1675). Extant copies vary in their contents, but tend to include between 26 and 40 charts covering Europe, North America and the Caribbean. It could also have been Joseph Moxon's *Book of sea plats* (1657) although this was limited to charts of Europe and so would not be useful to a mariner like Friscoe crossing the Atlantic. His collection of Dutch and English charts suggests that mariners owned combinations of charts and atlases, probably according to availability and cost, and consulted multiple sources of geographical information to achieve a synthesis of information. Captain Ellyson Armistead, whose inventory was also taken in Virginia, owned four large maps and three smaller ones.[52] His position as a captain and as someone who died in Virginia suggests that at least some of these maps were used for his work. Another mariner, Robert Francis, owned three 'great paper maps', as well as 'small sea instruments, sea books and sea maps' valued at £3.[53]

On his voyage to the Straits of Magellan in 1669, John Narborough navigated the *Sweepstakes* using a 'Duch plano chard' and an English Mercator chart.[54] The use of a mercator chart contradicts E.G.R Taylor's conclusion that a Mercator projection was a scholar's map that an 'ordinary sailor could have made nothing of'.[55] Although it can be argued that Narborough was not an 'ordinary sailor', the use of Mercator charts in teaching at the RMS suggest that it was more widely used than thought by historians. Narborough also used knowledge of previous voyages - on 3 April 1670 he referred to voyages by Hakluyt, Francis Drake, and Nunez de Silva - and trial and error such as on 3-5 April 1670 when the *Sweepstakes* sailed north and south of Port St Julián, unsure of the exact location of the harbour.[56] Similarly, when the convoy reached the Cape Verde Islands, Master Mate John Wood wrote,

> By my reckoning I sayled by a Duch draught printed 10 leagues to the eastward of Acention and by an English draught 30 leagues made by one welch but by one of mercators leagues the Hollands draught maketh the land lye 100 leagues more to the westward then our English one.[57]

In charting the course to the Cape Verde Islands Wood used two different charts — English and Dutch Mercator — as well as using trial-and-error to judge their position. This highlights the practice of using a range of sources available, and making navigation judgements based on a synthesis of this information and the practical course of the voyage. It highlights that navigators used their common sense and experience in conjunction with the printed geographical information in try to produce the best course for the ship, but that obtaining printed maps and charts was an important part of navigation. Wood's comments regarding the competing latitudes of the Ascention islands on the Dutch, English and Mercator charts highlights the difficulties facing navigators when determining a ship's course, as well as highlighting his awareness of the

[52] Ibid
[53] Overton, Whittle, Dean and Hann, *Production and consumption*
[54] 'Journal of J. Wood of a voyage from England to Patagonia', Sloane MS 3833, British Library (no folio numbers)
[55] Taylor, *The haven-finding art,* p. 222. Taylor acknowledges that Edward Wright's work on Mercator projection charts in the late 16th century made the charts more user-friendly for mariners; however she argues that advances in navigation techniques generally made little impression on ordinary mariners in the 17th century
[56] John Narborough journal and instructions Add MS 88980, BL
[57] 'Journal of J. Wood'

potential variations of latitude on printed charts. Crucially however awareness of the variations also suggests his abilities to negotiate these differences and still keep the ship on course.

Evidence that maritime demand was significant in the map and chart trade knowledge in London is supported by analysis of the preparations made for six ships sailing in the voyage to Darien, Panama in 1699 as part of the Company of Scotland's project to settle a Scottish colony in the Americas.[58] Invoices supplied to the Directors give a detailed picture of the items considered necessary, as well as the costs of provisions and supplies.[59] Insh claims that the instruments, charts and navigation books were bought in London by Dr John Munro on behalf of the Company, demonstrating the importance of London as a centre for this type of knowledge.[60] The ships were equipped with six 'West India Waggoners', costing 14-16s each, which were sea atlases specifically about navigation to the West Indies. The inventories do not give more detail about the atlas publishers, but it is possible that they were the *English Pilot: Book IV West India Navigation* first published by John Seller in c.1675.[61] They also bought six Mercator charts, five in colour.[62]

Figure 3: Maps, charts and atlases bought by Company of Scotland for Darien voyages, 1699

Item	Cost
1 mercator chart	8s
1 West India waggoner (atlas)	16s
5 Mercators Charts, coloured	£1.10s
5 West India waggoner (atlas)	£3.12s.6d

Geographical objects were also used in mariners' preparation for going to sea. Edward Barlow was apprenticed to the chief master's mate on the *Naseby* in the 1650/60s. Barlow claimed that he was not able to write before going to sea, but that 'though my master did but show me little concerning navigation, yet if I had given my mind to have learned it from another, my master would not have been unwilling to pay for it'.[63] His uncle bought him 'some necessaries', possibly maps, charts or books that might aid him in learning about

[58] These voyages are discussed in more detail in chapter 5
[59] Historian Douglas Watt omitted navigation instruments and maps from his analysis of the preparations for the Darien voyages. Douglas A. Wood, *The price of Scotland: Darien, union and the wealth of nations* (Edinburgh, 2006) pp. 117-133
[60] George Pratt Insh, *The Darien scheme* (1947) p. 114
[61] Coolie Vernie, *A carto-biographical study of The English Pilot: the fourth book* (1960)
[62] A Mercator chart is a drawn to the Mercator projection, which takes into consideration the earth's curvature, and represents lines of longitude in relation to this curvature. It was first drawn by Flemish map-maker Gerardus Mercator in 1569, and was increasingly used in map and chart publications in the 17th and 18th centuries. Although it distorts the size of objects as latitude increases towards the Poles, it displays with straight lines that can intersect with latitude lines rhumb lines. Mark Monmonier's account of the projection contains many interesting, if ahistorical observations: Mark Monmonier, *Rhumb lines and map wars: a social history of the Mercator Projection* (Chicago, 2004)
[63] Barlow, p. 30

navigation.[64] He was apprenticed for seven years, but on his last voyage, described how his master would not teach him more about navigation – 'although he was to learn me the mariner's art, he did not strive to show me', indicating that a mariner could not always rely on the goodwill of a master for an education and instead may have used printed information.[65]

The growing Atlantic trade also required navigation and geographical information. In total around 335 ships left London in 1686 to engage in plantation trade in Africa, the Caribbean and North America.[66] A thriving trading system also existed between American colonies which increased the number of English ships arriving and departing from colonial ports.[67] In 1661 200 ships arrived in Barbados, increasing to 422 by 1686.[68] Not all of these were English, which highlights the competitive incentive to successfully navigate the Barbadian coastline. The mean size of Atlantic trading ships was 180 tons, and according to Nuala Zahedieh, Atlantic-bound ships carried one man per 9 tons (incidentally twice the number than in the North European trade).[69] This suggests that London's Atlantic fleet employed 3,240 mariners in the 1660s and 6,300 by the 1680s. By these rates, the mean ship of 180 tons would have 20 crew members, and the captain, master and master's mate would have each had some level of responsibility for navigation. With high mortality rates on Atlantic ships, a wise Captain would probably have ensured that at least 2 additional crew members would be able to take over if tragedy befell the Captain (as happened in 1701 on Uring's ship).[70] This suggests that the average-ton ship entering London from the American colonies would have 5 crewmen required to demonstrate some navigation and geographical proficiency. Most Captains supplied their own instruments to ships, therefore it was probably that the mate and other mariners with responsibility for navigation would also bring along their own materials. As a source of demand, then, the 335 ships entering London in 1686 would have constituted demand for maps, charts and instruments from around 1,675 individual mariners. This was unlikely to have been an annual demand because demand for maps and instruments was almost certainly not linear, but rather determined by the shelf-life of each object subject to wear-and-tear or loss at sea, or the need to replace the map or chart with an updated version. Maps and charts of the Americas and Pacific were advertised as new and updated, with significant variations according to region, but, for example, a new map of Jamaica was published on average every 18 months between 1660 and 1720. Charts were less frequently published, and the first English atlas of the Atlantic wasn't published until 1675, highlighting that assessing demand is not as straightforward as applying the number of mariners to number of ships; however this can give an assessment of the potential size of the market. Of the whole crew, Captains probably valued up-to-date charts and maps the most, with mariners further down the pecking order purchasing maps to satisfy curiosity rather than from professional obligation.

[64] Ibid
[65] Ibid, p. 49
[66] Ralph Davis, *The rise of the English shipping industry in the 17th and eighteenth centuries* (1962), pp. 7, 298-9, 395
[67] O'Malley argues that inter-colonial slave trade powerfully shaped the early development of the colonies. O'Malley, *Final Passages*
[68] Zahedieh, *The capital and the colonies,* p. 144. Naval Office shipping returns refer to merchant shipping only and did not include naval ships
[69] Ibid, p. 159
[70] Uring, p. 31

Instruments had longer life expectancies, but compasses still eroded at sea and log-lines could be quite easily lost, but overall instruments may have lasted for several years.

Captains also sometimes employed pilots to perform the difficult and risky navigation through straits, narrows and shallow seas to reach ports.[71] The captains of the Darien expedition ships deemed the Orkney Islands in Scotland tricky enough to warrant hiring a dedicated pilot.[72] Nathaniel Uring's deference to the pilot he found on the Mosquito highlights the trust placed by captains in the superiority of local knowledge of pilots, probably a result of a captain's own lack of confidence born of limited experience of a region. Although the specific locality of the knowledge demanded from pilots could suggest that maps, charts or printed geographical knowledge would have had limited value for them (indeed Joyce Chaplin argued that it was this local knowledge that made captives so valuable to captains who tried to use them as pilots), as their own knowledge would have been at the forefront born through their own practices as a pilot.[73] However it seems probable that a wise pilot would also buy new charts in case it augmented their own knowledge, and the expansion of the boundaries of the Atlantic and Pacific world also expanded the amount of new and unfamiliar territory to be navigated by pilots.

The navigation capacities of English mariners was also a growing concern for the English Crown and Parliament in the late-17th century. Royal Astronomer John Flamsteed expressed a Dessire for more navigators,

> able to make use of all those helps with which the discoveries of the age have furnished us. Had we skilled seamen, they could affect many improvements in our knowledge, providing for example, observations of the moon and of Jupiter's satellites for comparison with those made at Greenwich. Those necessary tables [for the longitude] are upon the anvil and will be completed within a few years, but their usefulness depends upon there being trained seamen to use them.[74]

Although he was writing to promote his own skills in teaching at the Royal Mathematical School, his call for 'trained seamen' reflected a unease common amongst his peers. Navigation training was almost non-existent in England until the latter 17th century, and relied on an informal apprentice system.[75] However, as Flamsteed wrote, 'the discoveries of the age' - both in the sense of expansion into the Americas and the developing experimental science including Flamsteed's own work – would be served by the creation of a labour force proficient in navigation. To invest in navigation was to invest in England's overseas empire - without skilled seamen trained in practical knowledge of the sea, England could not expand or consolidate its colonial trade routes and settlements. To help create this corps of trained navigators, in 1673 the Royal Mathematical School

[71] Trinity House in London had existed since 1514 to regulate pilots on the River Thames, but its influence did not spread much further beyond London
[72] See chapter 7 for further discussion of the Darien voyage
[73] Joyce Chaplin, *Round about the earth: circumnavigation from Magellan to Orbit* (New York, 2012), p. 32
[74] E.G.R. Taylor, *Mathematical practitioners of Tudor and Stuart England* (1954), p. 119
[75] Margaret E. Schotte, 'A Calculated Course: Creating Transoceanic Navigators, 1580-1800' Unpublished PhD thesis, Princeton University, 2014, p. 118. Trinity House expanded its remit from Thames pilots to regulating the training of navigators, and began to examine teachers from 1702 onwards. H.W Dickinson, *Educating the Royal Navy: eighteenth and nineteenth-century education for officers* (New York, 2007)

(RMS) was founded as part of the school for orphaned children Christ's Hospital, with an annual grant of £1,000 from the Exchequer to train boys in navigation and with patronage from Charles II's on the advice of Samuel Pepys. A mural painted in the school in the 1680s by Crown artist Antonio Verrio showed officials holding a large outstretched map, indicating the instrumental position the School hoped to play in England's imperial future. Pupils were issued with silver pin badges to indicate their enrollment in the school (see figure 4).[76] On the badge a boy stands in the foreground, receiving instruction from three figures on a sea shore, representing arithmetics, mathematics (with her hand on the boy's head, suggesting she was the most important) and astronomy. Around the image are a mathematical book, dividers, an armillery sphere, a cross-staff (above the shoulder of the right-hand figure), and a compass in a box on the shore. It neatly encapsulates the ambitions and desired proficiencies of the School and its pupils, aiming that the application of skill, knowledge and education to England's young men would boost the nation's maritime power.

[76] MEC0879, Badge of the mathematical scholars of Christ's Hospital, NMM, Greenwich, UK

Figure 4: Badge of the mathematical scholars of Christ's Hospital c.1673, National Maritime Museum, Greenwich, UK

The School aimed to train 40 boys or 'mathemats' each year.[77] Trinity House examined pupils before they began a seven-year apprenticeship at sea.[78] In 1676 Bartholomew Clement, Captain of the *Fortune* sailing to Virginia was paid £12.7s for taking pupil Richard Green as an apprentice.[79] The School paid for the first kit with instruments that pupils took to sea - in 1680, they paid £5.4s.6d for the 'apparrel and necessaries' for ten pupils placed as apprentices.[80] Professors were drawn from a circle of prominent mathematicians and fellows of the Royal Society, including John Flamsteed, author of *Principia Matematica* Isaac Newton, and Peter Perkins. This cross-over of instructors, fellows of the Royal Society, and politicians as well as empire highlight the small and overlapping circles of commerce, empire and science during this period. The programme of instruction included 'arithmetick', geometry, use of instruments, and plain and Mercator 'sayling'. When asked by the school Secretary what standard should be aimed for, Newton replied 'I will add, that if instead of sending the observations of Seamen to able Mathematicians at Land, the Land would send able Mathematicians to Sea, it would signify much more to the improvement of navigation and safety of men's lives and estates on that

[77] E.H Pearce, *Annals of Christ's Hospital* (1901), p. 101. The history of Christ's Hospital, and the Royal Mathematical School in particular, has received surprisingly little attention by historians including on the socio-economic backgrounds pupils and their careers after leaving the school
[78] Schotte, 'A calculated course' p. 120
[79] Christ's Hospital account books, MS12819 MF 10 LMA
[80] Ibid

element'.[81] To deliver this vision the governors promised to provide pupils with 'bookes, globes, maps and other Mathematicall Instruments'.[82] In total, from the school's foundation in 1673 to 1720 it bought maps and charts from ten sellers, instruments from 27 makers, and books from seven publishers in London. It spent a total of £1826.5s.46d on these items, an annual average of just over £44.[83]

Correct use of maps and charts was a priority for the school. One curriculum stated that the mathemats should learn 'questions of plaine sailing with the use of the plaine sea chart' as well as 'the solution of all propositions in geography in all the four various sictuations of places'.[84] Plain (or plane) sailing assumed the world was flat, and therefore that longitude lines were parallel to each other. To learn plane sailing pupils had to learn to read a sea chart, including calculating a course from A to B using longitude and latitude, and to record the ship's position. Between 1673 and 1720 the school spent £158.16s.8d, and an annual average of just under £3.7s, on maps and charts.[85] Although £3.7s annually was not a large amount to spend on maps and charts, and it certainly does not make the RMS a key driver in the trade on its own, it probably amounted to between 50 and 70 maps and charts per year, enough to supply the boys with individual copies. The RMS tended to purchase bulk orders, such as £4.15s to Robert Morden in 1675 for 'several mapps' and £15 to John Seller in 1682 for 'mapps and platts', suggesting that they did not make annual renewals of map stocks, perhaps because it was cheaper to buy in bulk. It also suggests that the School was not strongly concerned with the novelty of the information on the maps, as it did not buy newly released maps as they were published.[86] In contrast to scientists or state officials for whom novelty of information was a more useful attribute of maps designed to educate or manage the empire, the RMS may have concentrated on teaching skills that could adapt to changing geographical conditions, rather than teaching the most recent known geography of the world. These purchases and the decision to teach things such as plaine sailing charts suggests that these were broader practices by mariners and that demand for maps and charts extended further beyond the RMS into the general maritime market.[87]

[81] Taylor, *Mathematical practitioners,* p. 119
[82] Ibid
[83] Christ's Hospital Account Books, MS12819 MF 11-13, Minute books MS12823/2, LMA. The account books (which were more comprehensive) stopped itemising payments in 1701, which partly accounts for the apparent reduction in spending. These numbers add to Alexi Baker's findings that concentrate on post-1700 and did not include the RMS account books (which ended in 1701)
[84] A. Blue, *Annals of Christ's Hospital from its foundation to the present time* (1867)
[85] Christ's Hospital Account Books, MS12819 MF 11-13, LMA
[86] On the other hand, these purchases may have been cumulative, with payments made once a minimum had been reached
[87] The School's decision to teach both methods of plain sailing and Mercator sailing further develops Gillian Hutchinson's point about mixed practices by navigators in England in the late 17th-century, highlighting that even mariners in the School were taught both methods. Hutchinson, 'Mercator's Projection' pp. 155-157

Figure 5: Maps, Charts and Atlases Purchased by the Royal Mathematical School 1673-1720[88]

Name of Seller	**Total Amount Paid by Christ's Hospital**	**Dates**	**Selected Items Purchased**
Robert Morden	£9.5s	1675, 1690	Maps
Obadiah Blagrave	£21.3s.4d	1679, 1680	Sea chart with 'soundings drawn by hand'
Moses Pitt	£11.8s.4d	1682, 1683	English Atlas
John Seller	£64.2s	1684-1698	Maps and platts
Samuel Stuart	£7.18s	1683-1699	'printing of 2000 prints of severall platts', 'printing off from copper plates charts maps '
Thomas Beckett	£1.15s	1690	Maps of fortifications
John Toogood	£17.17	1686-1690	Maps
Isacc Niclass	£4.8	1696	Maps
Richard Mount	£15	1706	Maps
Charles Price	£6	1710	Maps

Analysis of the sellers offers clues about the maps and charts bought. Payments to John Seller constituted 46% of total expenditure between 1673 and 1700 (Seller died in 1698).[89] Seller sold charts, atlases and navigation texts, and some maps.[90] He produced the first English sea atlas, the *English Pilot* in six volumes with volume four focussing on Atlantic navigation, and it seems very probable that the School bought copies of these.[91] He also sold the *Atlas Maritimus* (1675) the first edition of which contained 34 charts, 13 of coastlines of North America, Spanish America, or the Atlantic Ocean.[92] Other maps sold by Seller were *A map of New Jersey* (1677), *A chart of ye north part of America* (1677) and *A chart of ye Caribe Islands*. These maps were largely practical not decorative, indicating how maritime demand could shape the output of publishers. The stock of another of the publishers, Robert Morden, included *A new map of the English plantations in America* (1673), and *A*

[88] Although at first glance it seems like spending on maps reduced dramatically after 1701, in fact, after 1701 RMS stopped recording individual purchases in the account books, which means that information about expenditure on objects comes from the minute books which contained less detail than the account books

[89] Alexi Baker noted that John Seller was also one of the main instrument suppliers to the School. Baker 'This ingenious business'

[90] Coolie Verner, 'John Seller and the chart trade in seventeenth century England' pp. 127-158 in Thrower ed., *The compleat plattmaker*

[91] John Seller, *The English Pilot: the fourth book, West India navigation* (various editions). Financial difficulties caused Seller to enter into partnership with a number of map publishers. The group consisted of William Fisher, John Thornton, John Colson and James Atkinson. Valerie Scott ed., *Tooley's dictionary of mapmakers: revised edition Q-Z,* (Connecticut, 2004), p. 144

[92] John Seller, *Atlas Maritimus* (1675). Maps C.8.b.13, BL. The charts were: *A chart of the north part of America; A chart of the West Indies; Chart of the Western ocean; a chart of the West Indies; A chart of the coast of America; A map of New Jersay; A chart of the Caribe islands; An accurate map of Jamaica; A chart of the Windward Passage; A chart of the sea coast of Brazil; A chart of the South Seas; A chart of the coasts from Lands End to Bona Esperanca; A chart of the island of St Helena and Bona Esperanca*

new map of New England: New York: New Jersey: Pensilvania: Maryland and Virginia (1685), which were possibly included in the RMS purchases.[93] They also bought copies of Moses Pitt *English Atlas,* a subscription-based project initiated by Pitt to produce England's first world atlas, and which ultimately ended in financial failure. The involvement of the RMS in subscribing to the project was probably the result of the involvement of figures such as Newton and Pepys in the School who had interests in the Pitt atlas, further indicating the position of the School within a culture of useful knowledge producers and initiators in London. Overall the RMS purchases highlight how demands for improved navigation skills to serve the interests of the English state intersected with the trade and map production skills in the English artisan community and supported the business of prominent map sellers.

The decision by the RMS to purchase maps and charts from English sellers suggests that they favourably rated the objects produced or sold by English sellers in London, contrary to some historians' claims that maritime culture in England in this period was forced to rely on continental cartographers. The case of John Seller particularly stands out. Historians' have argued that Seller was a plagiarist, following the lead of Samuel Pepys's questioning of the originality of Seller's work in his condemning comment 'My Lord, is, upon this trial of ours at our coming into the Channel, mightily convinced and angry at Seller's platt (made on purpose for him this voyage) proving worse than the Master's old Dutch ones'.[94] The RMS did not appear to share Pepys's view. Seller published over a third of their maps and charts bought by the RMS between 1673 and 1698 (Seller died in 1698), suggesting that were deemed to be of sufficient quality for a school operating under the guises of the Crown. Furthermore, they boosted their collection with other publishers' maps, suggesting that their loyalty was not from a sense of obligation resulting from his position as Royal Hydrographer. The purchase history also suggests that the trade in maps and charts in London was robust enough to consistently supply the School with objects – purchases were made on average every three years, suggesting that although demand was spaced out, trade was sufficiently large, stable and productive to maintain printing and publishing of maps and charts.

The School also seems to have bought custom-made maps for use in teaching from Obadiah Blagrave. Payments were made to Blagrave of £5.15s in 1679 and 1680 for sea charts including one with 'all the sea coasts and soundings drawn by hand'. In May 1683 they paid £1 to Samuel Stuart for 'printing of 2000 prints of severall platts' (maps).[95] £1 is very little for 2000 maps, which were usually priced at around 1s, suggesting that these were not ordinary charts. It is possible that they were blank, or had little information on them, which made them cheaper to produce, and that they were perhaps used for practice by the pupils.

[93] Scott ed., *Tooley's Dictionary of mapmakers,* p. 278
[94] Edward Chappell ed., *The Tangier papers of Samuel Pepys* (1935), p. 242
[95] Christ's Hospital Account Books, MS12819 MF 11-13, LMA

Pupils were also required to learn 'the construction and use of right-lined and circular maps, the practice of drawing for laying down the appearances of Lands, Towns, and other objects of notice'.[96] A 'right-lined' map was a map drawn at a plane projection, with latitude lines spread horizontally across the map intersecting longitude vertically, plotting the position of places along the right-angles (see figure 6). A 'circular' map was as a map drawn to Mercator's projection. The instructions highlight that pupils were taught practical hands-on skills that required the use of precision drawing, mathematical calculations, and application of problem-solving. The syllabus also stated that boys should learn 'plainsayling, the construction and use of the Plain sea chart in all the cases thereof, the working of the Traverse, the solution of all Plain sayling questions […] with absolute directions for keeping a Journall at Sea'.[97] This instruction involved the pupils learning both the practical skills to use a chart at sea, as well as how to make their own chart from observations of the course of the ship. A 'traverse' was a wooden board with holes and pegs used to record dead reckoning and the progress of a ship. Mariners moved the pegs on the board to record direction of the ship using compass observations, as well as speed. Finally pupils learnt how to keep a sea journal, which involved daily recordings of latitude, longitude, corrected observations. Both the use of traverse board and keeping a sea journal required understanding of mathematics, consistent record-keeping and precision observations. The focus on teaching practical skills highlights how pupils were required to learn technical and mathematical methods that could be repeated and re-used at sea and other scenarios.

A manuscript chart in the John Carter Brown Library, United States that appears to have been drawn by an RMS pupil indicates practices of map plotting and drawing (figure 6).[98] *A mercators chart by John Crane* was drawn in 1684, and is 452 x 642cm in size, which was just slightly above average for printed maps during this period. It was a world map, showing the American, European, African and Asian continents. In addition to the plane projection, it also had two double-hemisphere drawings with a polar projection and mercator projection. All three drawings had longitude and latitude scales marked. If indeed it was drawn by an RMS pupil, it provides evidence of teaching of skills required to produce precision drawings, indicated by the use of straight lines, inclusion of latitude and longitude and the attempt to draw the world using a Mercator Projection. Although mariners were unlikely to have drawn whole world maps whilst at sea, the use of drafting and plotting skills were useful in keeping the ship's course as well as drawing observations of coastlines.

[96] Blue, *Annals,* p. 120
[97] Blue, *Annals,* p. 120
[98] Cabinet A684 CrJ Ms., John Carter Brown Library, Rhode Island, US

Figure 6: *A Mercators chart by John Crane* (1684)

A number of smaller private schools also offered navigation and mathematical instruction in London. Information about these schools is unfortunately hard to uncover, but it seems that there were at least ten, some of which were located in the maritime east of London. These were Cornhill (Reeve Williams), Goodmans Fields (John Colson), Bread Street (R Sault), Wapping (Samuel Newton), Rotherhithe (James Atkinson), Ratcliff Arms (Mr Linton), Armitage (Mr Hindmarsh), and two endowed maths schools, one in Rochester and in the City under the will of Joseph Neale (Neales Mathematical School).[99] These schools also probably purchased geographical objects to support their teaching and encouraged pupils to also purchase materials. One advertisement published in London boasted that a private master could teach any student above the age of 12 in one week 'the Use of all the ordinary Sorts of Charts Maps, whether Geographical, Hydrographical, Plans, Groundplots, or Perspectives […] with the Use of the Lines in the general Map, and taking of Longitudes and Latitudes, with the Use of Scales of Miles'.[100] These certainly purchased maps, charts, books and instruments to deliver their teaching.

[99] Taylor, *Mathematical Practitioners,* p. 143
[100] 'Geography made Easy' advertisement, BL Bagford Collection. Harl. j947, nos. 100-101

Evidence from mariners' journals also suggest that making maps and navigational drawings was common at sea.[101] Edward Barlow included 55 pencil drawings of coastlines in his journal. An editor of Barlow's journals, Basil Lubbock, described these as 'invaluable to the navigator in a day when charts were either non-existent or inaccurate'.[102] John Taylor also made drawings on voyages - he sailed from England to Jamaica in 1686, and after arriving in Port Royal, became a clerk on the *Foulcan.*[103] The manuscript copy of his diary in the National Library of Jamaica shows that he drew the island in 1689 with a detailed outline, 58 towns and coves marked along the coastline, 64 soundings and islands at Port Royal and Old Harbour.[104] He plotted the map to a scale of 24 per miles per cm in the island interior and drew the Blue Mountain range crossing from the eastern tip to the western tip of the island. Taylor's map did not add anything in geographical or navigation terms compared to the map of Jamaica published by Richard Blome in 1672, but it highlights skills in recording information. However, Taylor did make other drawings that were unusual compared to published geographies. A small illustration showed the coastline with mountains rising from the land, with the description 'a prospect of Jamaica, projected according to the range of vision for when the windward point 8 miles from you west, distant twenty four miles it then appears as in the above figure'. He also drew Port Royal, showing both the harbour with soundings and shoals, and shoals and inlets on the headland to the west.[105] The town and Fort Charles were drawn in detail, with individual streets depicted as well as churches and houses. Taylor made another drawing of the 'Ambriogias' banks north-east off the island of Hispaniola. It showed the south-western part of the island, with six large sand banks with water depths drawn to the south and west of the coast. In the title John Taylor claimed that he had projected and drawn the chart himself. In total Taylor included 12 drawings of islands or bays in his journal. The majority of these were smaller in scale and scope than the maps of Jamaica and Hispaniola, but they included detailed coverage of sand banks, rocks and water depths. They included latitude scales, and some indicated the scale to which they had been drawn. They indicate that mariners had skills to observe and draw geographical information using principles of precision drawing, and that they valued recorded information like water depths, rocks and latitude scales. It suggests that the practices taught in the RMS that emphasised using and drawing maps and charts, and precision-based mathematical skills were replicating mariners' skills at sea. As well as helping to pass time, it seems probable that these drawings were a way of augmenting existing charts and maps, and of recording information both for future inclusion into printed knowledge about a region, and to mark the ship's course.

[101] The following chapters about voyages to Spanish America and the Pacific highlight examples of mariners, including privateers, recording geographical information in this manner

[102] Basil Lubbock, *Barlow's Journal, transcribed from the original by Basil Lubbock* (1934), p. 2

[103] David Buisseret edition of Taylor's diary did not include many of the ordinary geographical drawings and information included in the manuscript diary. David Buisseret ed., *Jamaica 1687: the Taylor manuscript at the National Library of Jamaica* (Kingston, 2008)

[104] John Taylor map of Jamaica 1689, MS1051, National Library of Jamaica, Kingston, Jamaica

[105] John Taylor map of Port Royal 1689, MS1069, National Library of Jamaica. Until it was replaced by Kingston followed destruction in the 1692 earthquake, Port Royal was the main port in Jamaica with 8,000 inhabitants

Instruments

Mariners also used navigational instruments to find position and steer course and to record new information. They ranged from simple and quotidian, such as compasses or log-lines, to more complicated such as back-staffs and quadrants, both in terms of design and techniques for use.[106] Instruments like the forestaff required more complicated arithmetic to turn a celestial observation into information that would usefully determine the ship's position, whereas a log-line yielded information about speed or water-depth more straightforwardly. Historians argue that instruments became important in Baconian science.[107] W.D. Hackman writes that 'scientific instruments became indispensable in collecting and dissecting natural phenomenon in the 17th century, leading to the development of techniques that are at the root of modern science'.[108] Other historians have identified the relationship between overseas travel and instruments as a symbol of new science as well as enabling the collection of essential information.[109] However these perspectives have overlooked how trade and cross-Atlantic and Pacific voyages created opportunities for navigators to use instruments to observe new information and correct pre-existing errors. Mariners sailing into the South Atlantic to trade in Spanish America and cross into the Pacific or South Seas faced the additional challenge of calculating the declination of the sun using different arithmetic and without the pole star that was visible in the Northern hemisphere.[110] The relative inexperience and limited knowledge of American geography made using instruments more crucial to successful outcomes of their voyages. Some historians question the extent to which navigation instruments such as quadrants were really used at sea and by mariners, with some such as the armillary sphere regarded more as show-pieces in makers' shops to supply as decorative or status objects.[111] The elaborate depiction of these instruments on trade cards by sellers Charles Price and John Seller and their regular inclusion in portraiture of socio-political elites from the period suggests that association with these instruments was indeed an exercise in asserting status. However, evidence from the Royal Mathematical School, and other documentary sources suggest that they were also bought by mariners and that they were used to collect information. Richard Blakemore suggests that in 17th-century navigation there was a distinction between simpler techniques and more complex instruments, with possession of instruments functioning as markers of 'maritime experience and social

[106] For comments on the history of navigation instruments see J.A Bennett, *The divided circle: a history of instruments for astronomy, navigation and surveying* (1987); Richard J. Blakemore, 'Navigating culture: navigational instruments as cultural artefacts, c.1550-1650', *Journal for Maritime Research,* Vol. 14, No.1 (2012), pp. 31-44; Richard Dunn, *Navigation instruments* (2016)

[107] For histories of scientific instruments in early modern Europe see Jim Bennett, 'Early modern mathematical instruments', *Isis* Vol.102, No.4 (2014), pp. 697-705; Albert Van Helden, 'The birth of the modern scientific instrument' in John Burke ed., *The uses of science in the age of Newton* (1983) pp. 49-84; Deborah Jean Warner, 'What is a scientific instrument, when did it become one, and why?', *BJHS,* Vol. 23 No.1 (1990), pp. 83-93

[108] W.D. Hackman, 'Scientific instruments: models of brass and aids to discovery' in David Gooding, Trevor Pinch, Simon Schaffer eds., *The uses of experiment: studies in the natural sciences* (Cambridge, 1990) pp. 31-66

[109] Marie-Noelle Bourguet, Christian Licoppe and H. Otto Sibum 'Introduction' pp. 1-19 in Bourget, Licoppe, Sibum eds., *Instruments, travel and science: itineraries of precision from the seventeenth to the twentieth century* (2002), p. 1

[110] See pp. 106-7 for further discussion

[111] David Waters argues that quadrants were little used because of lack of accuracy in measuring geographical positions, whereas J.B. Hewson writes that the Davis quadrant became the principal instrument for observations. Waters, *Art of navigation,* p. 61; J. B Hewson, *A history of the practice of navigation,* (Glasgow, 1951) pp. 76-77. See pp. 105-6 for further discussion

authority'.[112] It may have been the case that more expensive, fragile or less essential instruments such as quadrants were not purchased by each mariner going to sea, however it is probable that each ship sailing to the Atlantic or Pacific during this period had one. That makes around 335 annually in the 1680s, although the rate of replacement was almost certainly not annual. More quotidian instruments such as compasses and log-lines probably had a more frequent replacement rate and were more commonly owned by ordinary mariners, who had to supply their own instruments when joining a ship.

Between 1651 and 1701 the number of scientific instrument makers working in London increased from 43 to 123, with navigation instruments rules, quadrants, compasses and sectors often sold from maritime east London.[113] John Seller and Charles Price advertised their navigation instruments on trade cards that also promoted charts and mathematical books, suggesting that their consumer base overlapped. A trade card in a pocket atlas advertised 'All Sorts of Instruments Belonging to the Art of Navigation and Sold by Jeremiah Seller and Charles Price' in 1700, and included images of cross-staff, dividers, quadrant, lead-line, and a map.[114] Another advert in *Practical Navigation* published by John Seller in 1669 depicted an azimuth compass, mathematical book, protractors, globes, quadrants, cross-staff and telescope. Copies of *Practical Navigation* can be found in mariners' inventories suggesting that by including his advert in this text, Seller was appealing to an ordinary maritime market. The co-location of instrument sellers with mariners in maritime London suggests that a trade based around maritime demand for useful knowledge was operating.

Mariner's inventories provide concrete evidence that mariners owned navigation instruments. In 1678 John Rowan in York County, Virginia, was recorded to own 'a new compas for seamen', and Captain Charles Seabrooke owned six lead lines (12s), 3 log lines (4s.6d).[115] Alexander Young, (d.1702) owned 'a parcell of sailors books and instruments' that cost 12s. Admiralty ships inventories between 1685 and 1687 also reveal use of these instruments.[116] The ships' tonnage ranged from 120 and 150 - in the lower range of ships that sailed to the Atlantic and Pacific, which averaged at 180 tons. *Pollican*, 150 tons, carried at minimum '5 half minute glass, 1 half hour glass, 1 four hour glass, 4 compasses with wooden boxes, 2 compasses with brass boxes, 1 half wach glass broke'. The average Atlantic trader may therefore have carried at least 6 compasses and 8 glasses to measure time, as well as other instruments – the total Atlantic fleet then of around 335 ships in 1685 would have constituted demand of at least 2,010 compasses and 2,680 compasses. These instruments were vulnerable to degradation or breakage due to the impact of weather eroding copper compasses or glass

[112] Blakemore, 'Navigating culture' p. 36
[113] Gloria Clifton and Gerard L'E. Turner, *Directory of British scientific instrument makers 1550-1851,* (London, 1995), p. *xv,* 52, 165, 177; Alexi Baker 'The business of life: the socio-economics of the 'scientific' instrument trade in early modern London' pp. 169-191 in Finn-Einar Eliassen and Katalin Szende, *Generations in towns: succession and success in pre-industrial urban societies* (Newcastle, 2009)
[114] 'Engraved pictorial advertisement in a pocket celestial atlas by Jeremiah Seller and Charles Price, 1700', British Library Maps C.21.a.5
[115] Probate inventories from York County Estate, Williamsburg, Virginia, Colonial Williamsburg Foundation
[116] HCA 4/14, 'An index of the commissions and decrees for appraisement and sale of ships and goods 1685-1687', TNA

breaking. One mariner described to the Royal astronomer John Flamsteed the weather and tidal conditions at the European trading fort Cabo Cors on the Coast of Guinea but reported that 'a stranger by accident broke the cane [on a weathercane], so that I could make no further tryal'.[117] This suggests that the replacement rate was high, rather than instruments being purchases for life.

Figure 7 shows that compasses and glasses to measure time were the most common instruments carried. Half-watch, two-hour, and four-hour glasses were used to keep time on the ship rather than measure time for navigation purposes, however they remained a core part of the functioning of the ship and were almost certainly sold by the same makers. The ships also carried log-lines and traverse boards for use in dead reckoning sailing. These inventories did not include more complex instruments such as back-staffs, which were probably owned by navigators rather than the ship, and suggests that demand was probably largest for more quotidian items that were part of daily navigation and were also cheaper and more easily replaceable.

Figure 7: Instruments in Admiralty ship inventories 1685-87

Instrument	**Number**
Log-line	3
Dipsey (deep-sea) leads	5
Lead-and-line	6
Compass	48
Half-hour glass	18
Half-minute glass	20
Half-watch glass	6
Four-hour glass	3
Two-hour glass	1
Log/Traverse board	1

[117] 'Extract of a letter of Mr Heathcott to Mr Flamsteed from Cabo Cors castle on the coast of Guiney the 14th December 1683 concerning the tide on that coast, variation of the needle' *Philosophical Transactions* (1684) p. 578

Antiant staff	3
Marking sticks	6

John Narborough also took instruments with him to the Straits of Magellan, including an azimuth compass, a half-minute glass, a quadrant with 4 foot radius, a half-minute glass and a log-line. He used these instruments to calculate the locations of ports and islands, writing 'the mouth of Port St Julián lyes in the latt of 49 degrees, and ten minutes, as I observed by the quadrant that Mr John Davis inventd, and in longitude from the lizard of England 63 degrees and ten minutes'.[118] Captain Woodes Rogers used a magnetic compass to record magnetic variation in the Pacific in 1709-10.[119] Richard Ligon reported that at Falmouth mariners on became 'very uncertain upon what coast we were', and that the Master and Mates 'drew out several plots and landscapes, which they had formerly taken upon the Coast of England and France […] there they seldome use loggline or backstaff, but attend onley the tydes, compass, and card'.[120] This suggests that on familiar coastlines, mariners were comfortable using simpler instruments and probably their own experience. Ligon also described the use of a back-staff, writing that he aimed to learn,

> of the accompt of the Master and his Mates kept of the ships way, both for compass, card and log-line, together with the observations at Noon, by that excellent and useful instrument the back-staff, by which we knew to a mile the Latitude we are in; and if we had an instrument to find out the Longitude, as perfectly, every man might guide a ship, that could but keep an account.[121]

Ligon's claim was quite remarkable – he argued that experience and tacitly-gained knowledge of navigation and geography could be overridden or challenged by a mariner with access to charts, a compass, and instruments to measure latitude and longitude. According to Ligon, the only barrier to navigating was absence of an instrument to measure longitude. In other words, a mariner equipped with the necessary objects could sail a ship, even in the Caribbean where many English mariners were unfamiliar with local geography, without needing the years of direct experience or knowledge gained onboard ship. The only necessity was an ability to keep accounts - the ability to count, to record mathematical information, and to make accurate observations in a methodical and precise manner. Although Ligon's statements regarding navigation techniques should be read in the context of his explicit commitment to Baconian principles of prioritising empiricism over authority in

[118] John Narborough journal and instructions Add MS 88980 A
[119] 'The variation of the magnetical compass, observed by Capt. Rogers, commander of the ship Duke, in his passage from Cape St Lucar in Calefornia to the Isle of Guam or Guana, one of the Ladrones, with some remarks thereon' *PT* (1720), pp. 173-176
[120] Ligon, *A true and exact history,* pp. 1-2
[121] Ibid, p20

knowledge, the teaching of practical skills in instrument-use and chart-making and reading at the Royal Mathematical School suggests that other maritime practitioners also valued this type of formal knowledge.

The Company of Scotland Darien voyage invoices give a detailed pictures of instruments taken on a cross-Atlantic voyage and their cost. Figure 8 indicates the navigation instruments, books and charts taken by the six ships. They took 5 different types of compass, including copper compasses (which were the most numerable — 50 in total), compasses with cards, wooden point compasses, azimuth compasses and compasses described as 'point compasses'.[122] The azimuth compasses were by far the most expensive, costing £3.12s.16d and £4.17s for a large compass. They took 77 compasses at a total cost of £12.17s.6d. They also took lead-lines for measuring water depth, including 174 deep sea lines and hand leads. Nocturnalls, quadrants, forestaffs (cross-staff), gunter scales, plain scales, and half-minute dials also went, with one of each bought for each ship (with an additional two half-minute dials), costing a total of £5.8s.14d. The most expensive instruments were the quadrants, which cost £2.15s for 6, or around 9s each.

Figure 8: Maps and Navigation/Time-Keeping Instruments included in invoices for ships St Andrew, the Unicorn, The Rising Sun, the Hope, the Olive Branch, The Calidonia in July 1699[123]

Items purchased	**Cost**
50 copper compasses	£1.5
7 compasses with 9 cards	£1.2s.10d
Loadstone for 1 set with brass	8s
6 half-watch glasses	9s
8 half-watch glasses	4s.8d
8 half-minute dials	4s.8d
2 compasses	9s
2 point wooden compasses	1s.8d
Deep sea line and raban (ribbon) weigh, raban (ribbon) line 4d. 136 at 40	£2/14/4
Hand lead 10 12 ounces at 3d	2s.8d
10 wooden for maps at 12d	10s
2 point wooden compasses at 10d	1s.8d
20 lead line at 40	£5.12.9

[122] 'Point compasses' could be magnetic compasses with a card including points of the compass rather than degrees as on an azimuth compass.
[123] MS83.5.9 ship invoices, National Library of Scotland

6 quadrants	£2.15
6 forestaffs (cross-staffs)	£1.11.6
6 gunter scales	£1
6 plain scales	8s
6 nocturnalls	10s
12 point compasses	16s
1 azimuth compass	£3.12.16
1 large azimuth compass	£4.17

The Royal Mathematical School also bought instruments for use in teaching, as seen in figure 9. Between 1673 and 1720 Christ's Hospital spent £1354.18s.5d on instruments including compasses, quadrants, globes, and rulers from 27 instrument-sellers.[124] They also bought two telescopes, costing £3.10s each.

Figure 9: Instrument sellers to Royal Mathematical School, Christ's Hospital 1673-1720[125]

Name	Total Amount Paid by Christ's Hospital	Dates	Instruments Sold to Christ's Hospital	Instruments Known to Have Sold	Address in London
John Marke	£41	1676-	Unspecified	Alidade, chinometer, level, plane table, protractor, quadrant, rule, sector, sundial	The Strand
John Noseke	£5.13s.4d	1682-	Unspecified	Unknown	Unknown
John Toogood	£130.12s	1682-91	Compasses, rulers, others.	Unknown	Unknown
Elizabeth Toogood	£31.14s	1693-95	Unspecified	Unknown	Unknown
William Chimes	£12.13s	1682-83	Ovall compasses, quadrants	Unknown	Unknown
William Elmes	£9.18s	1682-84	Unspecified	Sundial, astrolabe, rule	Moorfields

[124] MS12819 MF 11-13, MS 12873A, LMA.
[125] Christ's Hospital Account Books stopped listing individual payments after 1701.

Henry Wynn	£30	1684	Unspecified	Barometer, compass, dip circle, drawing instruments, microscope, quadrant, sector, sundial, thermometer	Chancery Lane
Joseph Hone	£50	1684-85	Unspecified	Does not say in dictionary	Tower Wharf
John Seller	£165.7s	1684-98	Unspecified	Magnetic compass, rule.	Wapping, Royal Exchange, Cornhill
Elizabeth Seller	£17.10s	1698	Unspecified	Magnetic compass, rule	Wapping, Royal Exchange, Cornhill
Robert Morden	£10.10s	1690	Globes	Globes, other instruments	New Cheapside, Royal Exchange
John Marshall	£3.10s	1695	Telescope	Telescope	Ludgate
Jane Hayes	£17.7s	1696	Unspecified	Magnetic compass, nocturnal, quadrant, slide rule, sundial	Cornhill, Moorfields
John Rawley	£630.1s.12d	1696-1720	Unspecified	Unknown	Unknown
John Crooke	£246.10s	1697-1716	Unspecified	Drawing instruments, rules	Christ's Hospital (1713)
Jacob Matsen	£10.0	1699-1700	Unspecified	Unknown	Crown Alley, Upper Moorfields
James Farmer	£5.0	1708	Unspecified	Unknown	Well Close
Thomas Collingwood	£5.0	1711	Unspecified	Unknown	
John Harrison	£6.13.4	1714	Unspecified	Balance, Chronometer	Barrow on Humber
John Worgan	£6.0	1686	Unspecified	Alidade, compass (magnetic), plane table, quadrant, sector	Fleet Street, London
Thomas Gardner	£6.13.4	1688	Unspecified	Unknown	Cornhill, London
John Marshall	£3.10	1695	Unspecified	Telescope	Ludgate Street, London
Henry Parr	£5.0	1693	Unspecified		

Walter Henshaw	£6.13.4	1696	Unspecified	Sundial, drawing instruments, backstaff	Wapping, London
Samuel Saunders	£5.0	1708	Unspecified	Unknown	Long Walk, London
John Sexton/Senex	£6.0	1710	Unspecified	Globes	Fleet Street, London
William Haddon	£5.0	1714	Unspecified	Rules	Newgate Street, London

The instrument makers supplying the school specialised in trade of cheaper and simpler-designed instruments such as compasses, rulers and alidades, suggesting these were the bulk of the purchases.[126] The annual average expenditure on instruments was just under £32, including objects for use in teaching and to give to apprentices sent to sea, as in the case of one apprentice, Edward Flood, who lost his belongings during a storm on a voyage to Jamaica in 1680, and was supplied with new instruments.[127] The school paid for instruments specifically to be used for pupils at sea, and on 8 April 1682, paid £3.10s to William Chimes for quadrants for boys 'to be bound to sea service'.[128] Payments for mending broken globes and ships indicate that the instruments were clearly in use. In 1682 John Raven was paid £1.6s for mending a model ship, and both Robert Morden and James Moxon (who was paid £3.10s) visited the school to fix their globes.[129] The use of instruments in teaching navigation to boys who went on to become apprentices to Captains and practicing mariners at sea indicates that there was some valuing of the role of instruments in navigation. The concentration of expenditure on sellers like John Seller (£165.7s) and John Rawley (£630) suggest that the school was an important customer. Overall the spending on instruments indicates how the educational and political priorities of the school intersected with the market for useful knowledge as they placed demand on artisans to supply practical objects.

'Mathematical' Books

Mastery of some mathematics was essential to anyone wishing to become proficient in navigation.[130] Navigation manuals boasted that they could turn even the most ignorant novice into a successful mariner.[131] While these claims no doubt aimed to boost sales, they highlight the perceived importance of understanding

[126] Clifton and Turner, *Directory* (1995)
[127] MS 12873A, LMA
[128] Ibid
[129] Ibid. These payments also highlight the technical skills of Moxon and Morden, who are sometimes portrayed by historians as business men or publishers, rather than skilled artisans.
[130] Calculating a course involved some basic arithmetic.
[131] Adrian Johns argues that 'late seventeenth-century Londoners were steeped in the printed word', but also cautions against over-emphasising the replacement of other forms of knowledge with print, noting that manuscript production and circulation workshops prospered in this period. Adrian Johns 'Printing, publishing and reading in London, 1660-1720' in Patrick O'Brian ed., *Urban achievement in early modern Europe* (2001), pp.264-283, pp.1-2

mathematics to would-be mariners. Instruction books were a common way of accessing useful knowledge, and texts describing methods and guides for sailing were part of booksellers' trade. A variety of navigation manuals were available to buy in London, usually at prices that a mariner could afford - in 1668-1670 the *Term Catalogues* advertised six navigation manuals priced between 2s.6 and 3s.[132] *The mariner's magazine*, *The seaman's practice* and *Practical navigation* offered basic instruction as well as tables of calculations and arithmetical formulas to assist with corrections according to magnetic variation and celestial observations.

Mariners' inventories indicate that these manuals were taken to sea. John Frisco (d.1680) owned a copy of *The seaman's practice* by Richard Norwood. It was first published in the late-16th century and by 1678 was in its 13th edition. It promised instruction in 'an exact method or form of keeping a reckoning or journal at sea'. Alexander Young owned 'a parcell of sailors books', whilst Captain Charles Seabrooke owned '2 sea books'.[133] John Narborough wrote that in preparation to sail to Magellan, he read Hakluyt's description of the area in *Principal navigation* and he had information about Spanish understanding of the area, referring to Spanish names of islands and headways.[134] On 21 February 1670 Narborough wrote, 'We made the land beinge W from us and had 2,4 fathom the land which we made was Cape Blanco so called by the Spaniards but by the English Cape St George'. This further highlights mariners' abilities to synthesise information from different sources, and indicates that in cases where mariners could not buy geographical books in London, for example about the South Atlantic Spanish American coasts, they sourced other information, indicating the value of printed information as well as navigators' abilities to cross-reference information.

The Company of Scotland bought three different books for the Darien voyages, one of each per ship. The books included John Seller *Practical navigation, A seaman's practice* and another book *Calendars and practices. Practical navigation* was much more expensive than the other two books – costing £2.3s for five compared to 10s – perhaps due to its newer publication date, whereas the older texts were perhaps either second-hand or had depreciated in value.

The RMS also bought mathematical books, and between 1673 and 1720 spent £312.11s.33d on books from seven sellers, including £12 to Christopher Husley in October 1696 for 60 navigation books. [135] Mathematical books advertised in the *Term Catalogues* between 1668 and 1709 cost between 2s and 3s, and Husley sold each book for 4s, a total expenditure of £312.11s.33d indicates that the RMS may have bought between 1562 or as many as 3125 books in 43 years. This amounts to between 40 and 80 books a year, or one to two per student.

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[132] Term Catalogues, ed. Edward Arbor, Vol. 1. The advertised texts were William Leybourne, *Nine Geometrical exercises for young seaman; Mariner's Magazine, Sturmy's mathematical and practical Arts;* H Philippes, *The geometrical seaman, or art of navigation*; Henry Philippes, *A mathematical manual […] applied in arithmetick, geometry, astronomy, geography, surveying, navigation*; John Seller, *Practical navigation;* Joseph Moxon, *Tutor to astronomy and geography, or easie and speedy way to know the use of both the globes, celestial and terrestial*

[133] 'An inventory of the estate of John Frisco taken 13 February 1680; 'An Inventory of the Estate of Alexander Young taken 30 December 1701' 'An inventory of the estate of Captain Charles Seabrooke taken December 20, 1752' in Colonial Williamsburg Foundation digital library

[134] John Narborough journal and instructions Add MS 88980, BL

[135] MS 12873A, LMA

Figure 10: Mathematical Books Purchased by Christ's Hospital 1673-1720

Name of Bookseller	**Amount Paid by Christ's Hospital**	**Dates**
Adill Mill	£16.13s.6d	1674-1685
Obadiah Blagrave	£159.6s.18d	1676-1690
John Harris	£31.15s	1689
Edwards Brewster	£12	1697-1701
William Shrewsbury	£46.7s	1698-1701
Samuel Newton	£6	1696
John Hayley	£11	1699
Christopher Husley	£12	1696
Unknown (bought at auction)	£17.10.9	1684

The accounts did not record individual titles, but bookseller catalogues indicate the possible titles. Obadiah Blagrave died in 1691 and his stock was sold at auction in London. The catalogue listed over 300 titles, including ten texts related to mathematical and navigation instruction, including *Sturmys mariners magazine* and *Safeguard for sailors*.[136] A survey of Christ's Hospital library in 1807 listed additional texts including Richard Blome, *Geographicall description of the world* (1669), Joseph Moxon, *A tutor to astronomy and geography* (1699), and Richard Norwood, *The seaman's practice* (1699).[137] They were written in usually simple language, with step-by-step descriptions of how to follow methods, instruction diagrams. *Sturmy's mariners magazine* (1669) included tables of the sun's declination claimed to be 'newly calculated', tables of latitude and longitude, and 'a discourse of the practick part of navigation'. It gave instructions for sailing using plane and mercator methods, and in using a quadrant, cross-staff and other instruments with accompanying images and step-by-step examples in how to make observations.[138] Tables of latitude and longitude included places frequented by English ships in the Atlantic trades including Callabar and River Benin on the coast of West Africa, Barbados, 'Jamaica harbour', 'east end of Jamaica', 'west end of Jamaica', and ports in Newfoundland, New England and other parts of North

[136] 'A catalogue of books in quires. Being the intire stock of Mr. Obadiah Blagrave, bookseller, lately deceased', BL These are short-hand titles used in the catalogue and many had longer titles in publication. The remainder were *Atkinsons sea-mans tutor, art of navigation by Perkins; Blagrave introduction to astrology; Flavells sea-mans compass; Heylins cosmography; Moors arithmetick; Newtons cosmography*

[137] *Catalogue of books in Christ's Hospital library* (1874). Other texts included Henry Bond, *The longitude found, or a treatise showing an easie and speedie way as well by night as by day to find the longitude, having but the lat. of the place and the inclination of the magnetical needle* (1676); William Leybourne, *Cursus mathematicus: mathematical sciences, in 9 books, comprehending arithmetic, geometry, cosmography, astronomy, trigonometry, navigation* (1690); Nichlaus Mercator, *Nicolai mercatoris holsati institutionum astronomicarum* (1676); Jonas Moore, *A new systeme of the mathematicks, containing arithmetic, geometry, trigonometry, cosmography, navigation, doctrine of the sphere, astronomical tables, geography, designed for the use of the Royal foundation of the mathematical school in Christ's Hospital* (1681)

[138] Samuel Sturmy, *The mariner's magazine* (1669), pp. 80-85

America.[139] Richard Blome's *Geographicall description of the world* partly taken from the French text by Nicolas Sanson included partially-translated maps of South America, North America copied from ones by Sanson. The ownership of navigation and mathematical texts by mariners, the Company of Scotland and the RMS indicates their value both in the practice of navigation and in teaching and creating skills in navigation and mathematics.

The RMS also commissioned texts. In 1682 Blagrave published *The sea-man's tutor: explaining geometry, cosmography, and trigonometry,* written by Peter Perkins, a professor at the school. It promised to provide tables explaining longitude and latitude of sea-ports, meridian miles, declinations, use of the compass, kalendar, use of instruments and charts, and estimation of a Ship's Way by the log and log-line.[140] Perkins described the text as 'compiled for the use of the Mathematical School in Christ's Hospital London' and the text included a picture after the title page of 'one of the children educated in the Hospital', showing a young boy holding a sheet of paper with markings on. Jonas Moore also published a book for use in the school in 1681 called *A new systeme of the mathematicks, containing arithmetic, geometry, trigonometry, cosmography, navigation, doctrine of the sphere, astronomical tables, geography,* indicating that not only did the RMS economically support the trade in useful knowledge but it could also intellectually stimulate the market.

By 1720 pupils who wanted an education in mathematics and navigation leading to work on board ship could receive instruction in plain sailing, making Mercator and plain maps, use of instruments including compasses and quadrants, under sponsorship of the Crown and with instruction from some of England's leading scholars and skilled individuals. The Crown had invested £1826.5s.46d, or annual amount of £42, on useful geographical objects that pupils could read, write on, practice on, and finally take to sea as apprentices. A German tourist visiting London in 1720 commented, 'Next the hall is the new school of mathematics which is very fine. In it there stood several cupboards with glass doors, in which various globi and a certain number of mathematical instruments […] In a great cupboard near the door were some 400 mathematical books'.[141] Many of these objects were bought from London-based makers and sellers, whose work therefore contributed to these ambitions. The school's ambition, teaching programme and trade in useful knowledge was representative of a larger demand for maps, charts, instruments and books from the London maritime community, which was growing and expanding trade into regions previously unknown to English mariners. The Company of Scotland, aiming to establish a colony in a region little understood by Scottish mariners, spent £39.4s.5d on navigation instruments, charts, atlases and books for the voyage, while Captain John Narborough took a quadrant, log-line, and Mercator's chart amongst other items to sail to the South Atlantic.[142] Mariners, captains, Company directors and interested scholars economically contributed to the trade in objects in London, and as the Atlantic and Pacific trading zones expanded, the number of mariners participating in the trade also

[139] Ibid, pp. 207-212
[140] Perkins, *The sea-man's tutor* (1682)
[141] W. H Quarrell and Margaret Mate eds., *London in 1710 from the travels of Zacharius Conrad von Uffenbach* (1934), p. 87
[142] Company of Scotland accounts books MS 83.5.8, NLS

grew as well as their demands for new types of geographical information. The reliance of individuals and institutions on London sellers indicates that London could supply the trade and was becoming a marketplace for reliable, useful, and quality useful knowledge. The growth of maritime and trading requirements for the British American world indicates that imperial demand supported growth in useful geographical knowledge in London.

Chapter 2: Scientific and state demand for useful geographical knowledge

At the same time as the 'revolution in trade', ways of knowing, comprehending and manipulating the natural world for human understanding were changing in England. In 1626 Francis Bacon had envisaged *Soloman's house*, a research establishment where members would collaboratively investigate nature using principles of empiricism and experimentation derived from interactions with nature rather than ancient authority.[1] The founding of the Royal Society (of London for the Improving of Natural Knowledge) in 1662/3, with its antecedents in Gresham College and an Oxford University circle of professors, is often regarded as Bacon's vision embodied. The Royal Society reflected and generated an environment of enthusiasm for knowledge that, rhetorically at least, was collected, formed, expressed and governed through belief in the value of empiricism and eyewitness knowledge - knowledge formed through expert personal or collective interactions with the natural world was a prized objective of its emerging philosophy. Like the Royal Mathematical School, Royal investment in the Society signals Charles II's recognition that improved ability to exploit nature could enable expansion of the nation's political and economic frontiers.

150 Fellows were elected to the Society in May 1663 (the actual number was probably higher) and by 1675 the number of fellows reached about 200, falling to 100 in 1690, and thereafter steadily growing. In the 1660s and 1670s fellows expanded operations to establish their journal *Philosophical Transactions* and set up committees dedicated to topics including a history of craft and trades in *The history of trades* and magnetic variation.[2] Leading fellows worked on useful knowledge projects.[3] Robert Moray chaired a committee to investigate magnetic variation, and Robert Hooke ordered instruments to assess perspective from instrument-maker Anthony Thompson, which E.G.R Taylor suggests was to sketch coastal panoramas of the type seen in pilot-books and charts.[4] In 1664 the mathematical committee proposed 'to make an instrument, by which may be found a ship's motion through the water. Ordered that such an instrument be made and experimented on.'[5]

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[1] Francis Bacon, *The new Atlantis* (1626)

[2] *Philosophical Transactions* issued its first edition in 1665 and was initially the personal project of Fellow and Secretary Henry Oldenberg. Although it was only licensed by the Royal Society, it came to be considered, particularly in continental Europe, as an official publication of the Society. It published a combination of articles by Royal Society fellows, correspondence of editors with individuals, and articles submitted by English and continental natural philosophers. Its difficult early publication history is described by Noah Moxham, 'Fit for print: developing an institutional model of scientific periodical publishing in England, 1665-ca. 1714' *Notes and records of the Royal Society* 69:3 (2015) pp. 241-260; Adrian Johns, 'Miscellaneous methods: authors, societies, and journals in early modern England', *BJHS* 33:2 (2000), pp. 159-186. Marie Boas-Hall, *Promoting experimental learning: experiment and the Royal Society* (Cambridge, 1991)

[3] Some historians have argued that the focus on experimental knowledge declined in the 1680s as the limitations of the Society to collect this knowledge became obvious and fellows' interests became more theoretical. Larry Stewart argued that scholars have overstated the achievements and reach of the Royal Society, writing 'Sprat's *History of the Royal Society* publicly staked a claim in 1667 to a utilitarian science; yet more often disappointment marked the end of dreams of useful knowledge. The Society failed miserably to induce much in the way of public benefit'. However Stewart's analysis overlooked the role that the Society played as a promoter of the value of useful knowledge and a legitimator of knowledge claims, as highlighted by ongoing contributions by ordinary scientists to the *Philosophical Transactions* and artisans' reference to support of Royal Society for their work. Larry Stewart 'Other centres of calculation, or, where the Royal Society didn't count: commerce, coffee-houses and natural philosophy in early modern London', *BJHS* 32:2 (1999), pp. 133-153

[4] E.G. R Taylor, *The mathematical practitioners of Tudor and Stuart England,* (1954) p. 105

[5] Michael Hunter, *Establishing the new Science: the experience of the early Royal Society* (1989) p. 102

A number of members of the Royal Society were also involved in empire including Sir Jonas Moore who published the map 'America' in *A new geography* (1681).

The historiography of the Royal Society has largely focussed on leading gentleman philosophers. However these were not the only people in London or the British empire creating and using useful knowledge.[6] Margaret Jacob and Catherine Secretan identify the growing role of 'ordinary people' in England and the Dutch Republic, writing 'the heightened role for both Dutch and English commoners emerged initially because of the growing need for new skills and competencies, for individuals trained in specific practical and intellectual matters'.[7] Historians Margaret Jacob, Larry Stewart and Joel Mokyr emphasis the work of ordinary artisans, tradespeople, experimenters in early modern England applying their practical and craft-based knowledge and skills to scientific and technical problems.[8] The interest of the Society in documenting a *History of trades* is evidence of early members' awareness of the value of knowledge of ordinary experimenters and links between everyday trade-based science and the high experimental science that fellows like Hooke and Boyle performed. In this instance, Mokyr and Jacob's identifications of small-scale, localised, home-based experimenters are useful in suggesting how experimentation with useful knowledge may have worked. Although the Royal Society was validator and promoter of the developing philosophy of empiricism and practical, hands-on knowledge, the contributions of scientists on the periphery of the Society and ordinary artisans was significant.

Until the 2000s the relationship between empire and new science had been largely overlooked by historians, and although the rise of global history and attention to non-European sites of science led historians to consider the genesis of some scientific knowledge as born from global or imperial exchanges, the economic aspects of empire (rather than simply its status as a non-European space) have only recently begun to be assessed in closer detail. R. W Home described the 18th-century *Colonial and commonwealth fellowship* by which residents of Britain's colonies were elected to be fellows, and Raymond Sterns documented the introduction of experimental philosophy to the Americas by the election of Society fellows from British colonies as early as 1661.[9] The relationship between scientific institutions and empire has been documented by historians such as Richard Drayton, who stressed the role of Kew Gardens in London in collecting cash crops from colonies and

[6] Lissa L. Roberts, Simon Schaffer, Peter Dear eds., *The mindful hand: inquiry and invention from the late Renaissance to early Industrialisation* (Chicago, 2008)
[7] Margaret C. Jacob and Catherine Secretan, 'Introduction' in *In praise of ordinary people: early modern Britain and the Dutch Republic* (Basingstoke, 2013) p. 3
[8] The role of 'Great Man' scientists such as Newton and Hooke has also been diluted by recent scholarly analysis of collaboration between individuals, including non-traditional 'scientific' actors. However a glance at recent publication lists reveals that the great white man still features prominently in historical treatment of science. For example: Michael Hunter, *Boyle: Between God and science* (New Haven, Conn., 2009); Lisa Jardine, *The curious life of Robert Hooke: the man who measured London* (New York, 2003); Matthew C. Hunter's work on Robert Hooke's drawings in "Experiment, theory, representation: Robert Hooke's material models," in *Beyond mimesis and convention: representation in art and science*, eds. R. Frigg and M. Hunter (New York, 2010) pp. 193-219; Matthew C. Hunter "The theory of the impression according to Robert Hooke," in *Printed images in early modern Britain: essays in interpretation*, ed. Michael Hunter (Aldershot, 2010), pp. 167-190; and Matthew C. Hunter "Hooke's figurations: a figural drawing attributed to Robert Hooke," *Notes and Records of the Royal Society of London* 64 (2010) pp. 251-260; Marie Boas Hall, *Henry Oldenburg: shaping the Royal Society* (Oxford, 2002)
[9] R.W. Home, 'The Royal Society and empire: the colonial and commonwealth fellowship Part 1. 1731-1847', *Notes and Records of the Royal Society of London,* Vol. 56, No.3 (2002), pp. 307-332; Raymond Phineas Sterns, 'Colonial fellows of the Royal Society of London, 1661-1788', *William and Mary Quarterly,* Vol. 3 No. 2 (1946), pp. 208-268

aiding in land management, and Robert Stafford has connected the work of the Royal Geographical Society to exploitation of colonial natural resources.[10] This discussion builds on work by Maxine Berg, Richard Drayton, Kathleen Murphy, Georgio Riello, Nuala Zahedieh and others who have drawn connections between early modern science, overseas trade and empire.[11] It highlights that useful knowledge of the Americas was a priority of early modern scientists who recognised the role of ordinary citizens in collecting practical information, that these scientists themselves were part of the market for geographical objects and had the capacities to judge and assess useful knowledge, and that this information was born out of the new science's recognition of the centrality of empire to Britain's economic and intellectual future. This discussion assesses how demand for useful knowledge of empire invoked demand for geographical objects, knowledge and skills, and how Royal Society fellows and interested scientists on its periphery engaged in a market for this knowledge, using useful geographical knowledge to do so.

Royal Society members' interest in maritime knowledge is demonstrated by their collection of navigation instruments. Account books reveal that between 1660 and 1672 the Society spent at least £24.18s.6d on instruments.[12] Figure 1 reveals the scope and breadth of these purchases.[13] Whilst these instruments had a range of uses – for example a compass may be used to measure a magnetic field as well as in navigation - they were probably supplied from the same makers, indicating the role played by fellows in demand for these objects in London. Margaret Deacon discussed in detail the enthusiasm of Robert Hooke, Robert Boyle for 'scientific investigation of the sea', as well as interest by fellows in tidal movements, although she accredits this to interest in cosmology or 'curiosity about the natural world'.[14] These were practical experiments related to questions of value to merchants, navigators and mariners – how to better observe, understand and manipulate nature in a way that would enhance human control of geography.

Figure 11: Instruments purchased by Royal Society 1660-1672

Item	**Cost**
2 needles	10s
Card-needles	5s

[10] Richard Drayton, *Nature's government: science, imperial Britain and the 'improvement' of the world* (New Haven, Conn., 2001)*;* Robert A. Stafford, *Scientist of empire: Sir Roderick Murchison, scientific exploration and Victorian imperialism* (Cambridge, 1989)

[11] Maxine Berg, 'Useful Knowledge, 'industrial enlightenment', and the place of India', *Journal of Global History,* 8: 1 (2013), pp. 117-141; Drayton, *Nature's Government;* Kathleen Murphy, 'Collecting slave traders: James Petiver, natural history and the British slave trade', *WMQ* 70: 4 (2013), pp.637-670; Giorgio Riello, 'Asian knowledge and the development of calico printing in Europe in the seventeenth and eighteenth centuries', *Journal of Global History,* 5:1 (2010) pp. 1–28; Larry Stewart, "Global pillage: science, commerce, and empire," in Roy Porter ed. *The Cambridge History of Science*, *Volume 4: Eighteenth-Century Science*, (2003), pp. 825–44; Zahedieh, 'Colonies, copper and the market for inventive activity in England and Wales, 1680-1730', *EHR,* 66 (2013), pp. 805-825

[12] Royal Society account books, AB/1/1/1, Royal Society Library London

[13] A full list of these items is included in appendix 2

[14] Margaret Deacon, *Scientists and the sea, 1650-1900: a study in marine science* (New York, 1971) pp. 73, 117-131, 154-174

Pocket compass dialls	2s.6d
Dipping needle without box	5s
Loadstone in armed case	£1 .15s
Compass-dyal	2s
1 Azimuth compass	£5
Quadrant and staffs	£3.10s
Brass instrument to showing sayling, Mr Wren	15s
Loadstone unarmed	£3

Figure 1, showing the list of instruments purchased by the Royal Society, also demonstrates that buying instruments was not financially inaccessible to interested people. The Royal Society paid 2s for a compass-dyal, 10s for needles, whilst quadrants and cross-staffs (number uncertain) together cost £3.10s. The most expensive item was the azimuth compass, which cost £5, which would be a significant amount for an average artisan or non-gentleman. However the majority of items would be affordable for the middling sorts. Their relatively low cost also suggests that when items broke or eroded, it was financially possible to replace them. As a source of institutional demand, £24.18s.6d over 12 years is small, however interest in these questions probably spread beyond the inner circle to some of the other 150 plus members, and investigations by Moray, Hooke and others were happening in other households and workshops. Royal Society chronicler Thomas Spratt described how experimental science spread further beyond the meeting rooms of the Society,

> of our chief and most wealthy merchants and citizens, very many have affiliated it with their presence: and thereby have added the industrious, punctual, and active Genius of men of Trafick, to the quiet, sedentary and reserv'd temper of men of Learning. They have contributed their labours: they have heap'd their correspondence: they have employ'd their Factors abroad, to answer their inquiries, they have laid out in all countries for observations.[15]

Spratt had a vested interest in promoting the new science, however his allusions to activities by merchants and citizens suggests a wealth of scientific work hidden by historians' documentary focus on the Society elites, which is also supported by assessment of contributions by figures such as Richard Ligon, Richard Norwood and William Penn. Although these were not the 'ordinary citizens' that Jacobs, Mokyr and Stewart identified

[15] Thomas Sprat, *History of the Royal Society* (St Louis, 1958)

(but found limited evidence of), they were people temporally or socially on the periphery of the Royal Society who recorded and used useful knowledge.

Richard Ligon was an English Royalist made penniless following the Interegnum of 1649 who spent three years in Barbados after agreeing to work for Thomas Modiford, a planter on Barbados (and later Governor of Jamaica). He was an admirer of empirical methods, and an early subscriber to the principles that the Royal Society espoused 15 years later.[16] In his history of the island published in 1653, Ligon described his efforts to record the size of Barbados in 1647/8.[17] He reported that a Captain Swan told him that he 'once took an exact plot of the whole island, but it was commanded out of his hands by the then Governor, Sir Henry Hunks, who carried it into England; since which time, neither himself, nor any other, to his knowledge, had taken any'.[18] Ligon claimed that he tried to jog the Captain's memory, taking 'a little pains in the survey of his papers, to try to what could be found out there, that might give me some light in the extent of the island'. Swan eventually reported the length of the island, but claimed the breadth was very uncertain due to the 'nooks and corners that reach'd out into the sea'. Ligon explained that due to these difficulties of calculating width due to coastline undulations, he estimated the 'medium' distance of 14 miles which he then multiplied by the breadth of 28 miles to reach 292 square miles of the island.[19] He concluded that his 'enquiries' could not be further developed, and that he was 'compell'd to make my estimate upon this bare supposition'. Ligon possessed the ability and skill to perform the requisite geographical calculations to make his observation, communicated with other observers on the island, and looked at the maps produced by Captain Swan in order to build a geographical picture of Barbados that could give valuable insights into its economic potential. His efforts reveal the skill and objects used in the transferring of geographical information from the colonies to London, and highlight the role of mariners and colonists in collecting and producing this type of information to satisfy navigation needs, as in the case of Captain Swan, as well as their own curiosity as in the case of Ligon, who was probably also motivated by his financial ambitions for a career on the island. Ligon's observations were scrutinised and rejected in *Philosophical Transactions* in 1666 by an anonymous author who communicated a theory to Robert Moray about the causes of iron rusting in the Caribbean. The use of Ligon's conclusions highlights the practice of cross-referencing of useful information by contemporary scientists and the type of useful observations on the periphery of the Society. Ligon's work was also used by political administrators as well as

[16] Ligon wrote "I had it in my thoughts, to make an Essay, what Sir Francis Bacons experiment solitarie, touching the making of Artificiall Springs would doe." Ligon, *A true and exact history of the island of Barbados* (1657) p. 98
[17] Susan Scott Parrish argues that the text was commercially viable because it was a practical manual that was useful for colonists. Susan Scott Parrish, 'Richard Ligon and Atlantic science of Commonwealths', *WMQ* 67: 2 (2010), pp. 22, 209-248
[18] Ibid, p. 26
[19] Ibid, p. 26

scientists – the Committee of Trade and Plantations bought a copy of his text for 5s in 1676 – indicating the cross-over of functions of histories of empire and the work of curious observers of nature.[20]

The author of the *Philosophical Transactions* article questioning the causes of iron rusting claimed to have sailed from London to the Caribbean, and noted that houses further away from the seafront rusted less than those immediately on the seashore. He or she suggested that this observation highlighted 'the vanity of the argument of M. Ligons and others' that rusting was caused by hot and moist air.[21] The author also included descriptions of the Caribbean sea,

> When we were in the latitude of Barbados and had sailed so for two daies, and apprehended ourselves to be within 70 or 80 leagues, I observed that the sea was black and thick, not transparently blue and the foam against the ships was turbid, and another consistence'.

The account continued,

> 'I asked the Master, who told me, we were within 60 leagues of Barbados, and that the sea there was soundable, whereas before it was not so. But at Barbados in the anchoring places, it was blue; and as we row'd shoare, in the shallow it was whiteish: And so at Jamaica near the shore it is transparently white, but within three yards more, transparently blue.[22]

In observing the oceanic conditions the author probably used a lead-and-line, compass and a sea chart. Without knowing the identity of the author, it is difficult to speculate on the motivations for writing the article, however the detail indicates an interest and knowledge of oceanic science and navigation. Furthermore information about the distance of the ship from Barbados – 60 leagues – and the appearance of the sea in anchoring places at Barbados and Jamaica was of use to mariners who would navigate these regions. Colour and consistency of water could indicate sea depth as well as tides and currents, and mariners estimated position and distance from land according to previous estimates. Furthermore the author also sought the advice of the ship's master, claiming to gain the information through discussion with an experienced mariner. The author described wind conditions in the Caribbean, writing that 'in Jamaica every night it blows off the island every way at once, so that no ship can any where come in by night, nor go out but early in the morning, before the sea-brise come in'. These observations were augmented in a later account in 1668 in which the self-described 'curious traveller' made a number of corrections: 'the sea-brise comes not into Jamaica till 8 or 9 of the clock in the morning, and ordinarily ceaseth about 4 or 5 at night'.[23] While the inclusion of this information was probably also designed to boast the empirical credentials of the article to readers of *Philosophical Transactions,* its publication also serves

[20] Plantations Committee expenses, BL Add. MS 9767, f. 15
[21] 'Observations made by a curious person sailing from England to Caribe Islands' *PT* Vol. 2 (1666-67), pp. 493-500
[22] Ibid, p. 496
[23] 'The remainder of observations made in the formerly mention'd voyage to Jamaica', *PT* Vol. 3 (1668), pp. 717-722

as evidence of the Society seeking and circulating improved navigation and geographical information collected by mariners.

Another citizen on the periphery of the Royal Society and deeply involved in empire was Richard Norwood. Norwood was a mathematician and surveyor of Bermuda from 1613 and he published a map of Bermuda in 1622 as well as the manual *The seamans practice* in 1637.[24] He spent most of his life in Bermuda, visiting London occasionally. Norwood's profession required him to own surveying and navigation instruments and texts necessary to investigate geographical and navigation questions. In June 1667 he wrote to *Philosophical Transactions* that he had not previously heard of the Royal Society, but that he was pleased to offer his observations and 'very glad […] to advance such a noble design'.[25] Norwood described the geography of Bermuda,

> concerning the tides, I have only taken a general notice of them; as, that it is high water about 7 of the clock on the change day (in some creeks an hour or two later). The water riseth but little, as about 4 foot at a high water, but at the Spring-tides it may be a foot more. The tides without are very various in their setting. Sometimes the Tide of Floud sets to the Eastward, sometimes to the Westward.[26]

His attention to the timings of tides – important information for navigators approaching harbours and coastlines – indicate his awareness of the value of this information and that he knew how to record tidal changes. Although writing to the *Philosophical Transactions* was probably an effort to promote his own work, the publication of the information suggests it was considered worth publishing and the Society encouraged the collection and communication of useful maritime knowledge.

A final example is William Penn, founder of Pennsylvania as an English colony in 1681, who presented a map of Pennsylvania published by John Thornton to the Society. He claimed it was based on conversations with sea captains in the region and was to promote his settlement efforts (the same map also appeared in the Blathwayt Atlas collated for the Committee of Lords and Plantation). The map was partly based on one published of Virginia and Maryland by Augustine Hermann in 1673 but it showed Pennsylvania as a separate geographical space. The Chesapeake Bay and Delaware Bay were particularly detailed, showing five major rivers, inlets, and over 20 depth marks, advertising the colony as easily accessible and open for trade and transportation.[27] Accompanying text explained that 'the conveniency that belongs to the Province in point of Navigation is two fold: the one through Chesapeake Bay and the other Delaware Bay, by which ships of great burthen may come and trade'. It promoted the economic potential of Pennsylvania in its productive soil and climate as well as potential for growing silk and other commodities, representing a more direct ploy to promote

[24] Michael Jarvis discusses Norwood's career and the contents of his maps and surveys. Michael Jarvis 'Bermuda's Doomsday Book': Richard Norwood's surveys and the development of the Somers Islands, 1613-1663' *Post-Medieval Archaeology* 45 (2011), pp. 54-73
[25] Richard Norwood 'An Extract of a letter, written from the Bermudas', *PT* Vol. 2 (1666-1667), pp. 565-567
[26] Ibid, p. 566
[27] *A map of some of the south and eastbounds of Pennslyvania in America* (1681)

empire through useful information than the articles by Norwood or Ligon. It also asserted that the map corrected previous errors. Following the presentation of the map Penn was elected a Society Fellow, and he sent periodic reports as well as plants and ore to Robert Boyle. Penn's election highlights the intersection between imperial interests and efforts to promote them through graphic and geographical claims to utility and economic potential, which in the case of the map of Pennsylvania involved application of an artisan's skills in London in producing the map, and scientific interest in the American colonies. Other men with one foot in the colonies and another in the Royal Society were William Byrd (in Virginia), William Burnett (New York, New Jersey, Massachusetts), Francis Nicholson (New England, Maryland, Virginia and others), and Thomas Hoy (Jamaica). Each of them recorded and communicated scientific information which required knowledge of the geography of the colonies as well as understanding of geography and navigation and instruments. They highlight the role that the Royal Society could play in acting as a repository or gathering point for people interested in and practicing gathering of useful knowledge, as well as suggests that curious people interested in obtaining useful knowledge and experimenting operated outside the immediate circles of the Royal Society committees.

The Society was also interested in information collected by ordinary craftsmen and labourers, including mariners and navigators. Instructions to mariners appeared in *Philosophical Transactions* in the 1660s asking them to record climatic, topological and hydrographic information and return their journals to Trinity House and the Royal Society.[28] Between 1665 and 1667, three sets of instructions were compiled by Gresham Professor of Astronomy and Geometry Laurence Rooke.[29] They explicitly appealed to mariners including masters, pilots and 'other fit persons' going into the 'East and West Indies', indicating that the Royal Society was interested in regions that, by virtue of the expanding commercial interests of England, were opening up to English mariners. They were asked to record information visually on 'platts and draughts', as well as keep an 'exact diary', so it could be collated and 'in time produce new and more accurate sea-maps and cards, than hitherto have been produced […] and great help and advantages to Navigation […] there being a design to consider all, and to draw out of them such rules and directions'.[30] Mariners were asked to observe tidal changes, record weather conditions including lightening, record compass variation, to measure sea depth, to mark latitude and longitude, and to take samples from sea beds. To chart dangerous geographical features, mariners should,

> remark curiously the situation; figures etc of all dangerous rocks, sands, channels, entries, and courses of rivers, and all difficult passages, and course in all places; to measure and describe the same exactly, their distances, bearings etc […] and make draughts, plots and maps of the, with their longitudes, latitudes, scales etc, and all beacons, buoyes, landmarks, lighthouses etc, which serve for directing the course of ships through narrow channels over bars and banks,

[28] These are briefly mentioned by Daniel Carey in the context of the importance of travel in early Royal Society science. The relationship to empire is not discussed. Daniel Carey 'Compiling nature's history: travellers and travel narratives in the early Royal Society' *Annals of Science* 54 (1997), pp. 269-292

[29] 'Directions for observations and experiments to be made by masters of ships, pilots, and other fit persons in their sea voyages', *PT* Vol 2 (1666-67), pp. 433-448

[30] Ibid, pp. 443, 448

> into Rivers, Ports, Bayes etc And to found depths near all Coasts, in all shallow places, Roads etc.[31]

This information was to be used 'to make platts and draughts of prospect of coasts, promontories, islands and ports, marking the Bearings and distance, as neer they can' and 'to sound and marke the Depths of Coasts and Ports'. Each of these observations required access to navigation instruments such as compasses, quadrants and log-lines, as well as the knowledge and skills to use them, and ability to record maps and charts with the observed information. Mariners were also told to carry instruments, including 'dipping needles', 'good scales and glasse-violls of a pint or so […] which are to be fill'd with sea water […] and the weight of the vial full of water taken exactly each time' and compasses. The methods advocated by the Society involved repetition and attention to comprehension in order to ensure validity of the information – 'these experiments are to be repeated every new voyage, the multitude and frequency of them being necessary for finding out and confirming the truth of them'. They requested information that correlated with geographical regions considered to be dangerous by contemporary navigators, and the specific focus on ports indicates their identification of 'problem' regions and dangers posed to ships. The article requested information on 'all other considerable accidents, they can observe in the tides, chiefly neer Ports, and about Islands, as in St. Helena's Iland, and the three rivers there, at the Bermodas etc'.[32] The Society also expressed specific interest in knowledge of the British Caribbean, and in 1668 an article asked for information about hurricanes,

> whether these terrible winds, which are said to have formerly happen'd in those parts but once in 7 years, do now rage once in two years, and sometimes twice, yea thrice in a year? And whether they are observed never to fall out but about the Autumnal Equinox; as t'is affirmed, that in the East Indies beyond the Line they never happen but about the Vernal? Whether they are preceeded with an extream calm and the Rain which falls a little before be bitterish and salt?[33]

These instructions required instrument use, precision observation, repeated and accurate recording, and show Royal Society recognition of the reserve of knowledge and skills held by ordinary mariners as well as the role of the Society in encouraging the application of practical skills and geographical objects. They highlight demand from the Royal Society for information that required application of mathematical knowledge, instruments, charts and other practical skills to the benefit of British imperial maritime capacities.

According to Thomas Birch, Royal Society fellow John Winthrop returned to New England from London with a copy of the instructions, with a dozen leads and other instruments to carry out the experiments.[34] They were reported to be largely a failure, prompting Robert Hooke to produce designs for new instruments

[31] Ibid, p. 439
[32] Ibid, p.142
[33] 'Enquires and directions for the Ant-Iles, or Caribbe-Islands', *PT* Vol. 3 (1668), pp. 634-639
[34] Thomas Birch, *A history of the Royal Society of London for improving natural knowledge* (1756), p. 207; Margaret Deacon, *Scientists and the sea, 1650-1900 : a study of marine science* (1971), p. 79

for sounding, described in *Philosophical Transactions* in 1666.[35] Another request and set of instruments were also given to Captain Thomas Holmes, who secured results in Cape Sainte Marie, Madagascar.[36] Historians assume that little useful information was returned to the Society, and Margaret Deacon argues that 'the reason we do not hear about them is the difficulty which observers had in obtaining unequivocal results'.[37] However, looking for concrete evidence of information returned to the Society misses the point – it seems certain that mariners recorded these forms of information on ordinary voyages, including latitude, tidal changes and dangerous natural features, as part of their ordinary activities at sea, and significance of the instructions is the Society's professed interest in the information that could be created by practitioners. It also demonstrates that the intentions and ambitions of the Royal Society as an institution involved demand for practical and crafts-led skills and tools, as well as material geographical objects and the knowledge of how to deploy them.

Other *Philosophical Transactions* articles reveal cases of individuals using and testing instruments or geographical knowledge, including tests at sea to improve knowledge of magnetic variation.[38] An article published in 1685 described the response of a needle when held to a piece of iron between the northern and southern hemispheres, with a focus on the crossing of the equator.[39] Another article (1668) described magnetic variation of a compass in relation to tides, and the author claimed to have received the information from Samuel Sturmy 'an experienced seaman and a Commander of a merchant ship for many years'.[40] Sturmy, who was also author of *The mariner's magazine,* claimed to have made the observations in the presence of 'an antient mathematician' in London. They used a six-foot radius quadrant and a 'very good needle about 8 inches long' and claimed that 'the observations shall be as exactly made, as can be done by men in any place in the world'.[41] Another article (1673) included the work of Henry Bond, who wrote histories of navigation, included calculations of magnetic variation made using a compass and inclinatory needle, and claimed to use observations of longitude taken at Cape Charles in Virginia, the Cape of Good Hope and the Straits of Magellan.[42] It seems probably that the measurements from the Straits of Magellan were those taken by Sir John Narborough on his voyage to Magellan in 1669.[43] In 1695 William Molyneux published his results of using a magnetic compass needle to take land surveys and he called on surveyors using 'magnetick instruments' to observe magnetic

[35] Deacon, *Scientists and the sea*, pp. 80-82; 'An appendix to the directions for seamen' *PT* (1666)
[36] Ibid, p. 79
[37] Ibid, p. 85
[38] Between 1665 and the end of 1720, 369 issues of *Philosophical Transactions* were published. 'The variations of the magnetick needle predicted for many yeares following' *PT* (1668) pp. 789-790; William Anderson and Captain Soame, 'Observations upon the variation of the needle made in the Baltick, anno. 1720' *PT* 120 (1720), p. 120
[39] 'Severall observations of the respect of the needle to a piece of iron held perpendicular; made by a master of a ship crossing the Aquinoctial Line anno 1684 and communicated by Mr Arthur Barly' *PT* (1685), pp. 1213-1214
[40] Margaret Deacon argues that tides were of crucial interest to Fellows interested in marine knowledge. Deacon, *Scientists and the sea*
[41] 'An extract of a letter, written by D.B to the publisher, concerning the present declination of the magnetick needle and the tydes' *PT* (1668), pp. 726-727
[42] 'The undertakings of Mr. Henry Bond Senior, a famous teacher of the art of navigation in London, concerning the variation of the magnetical compass and the inclination of the inclinatory needle, as the result and conclusion of 38 years magnetical study' *PT* (1673) pp. 6065-6066
[43] See chapter 3 for discussion of this voyage

variation in their calculations.[44] Another article posed the question of whether sea-compasses made in England were better than those made in other countries, and concluded that because the needles were made with 'good' and 'well-liberated' load-stones, English compasses were indeed superior, although they could be improved by adding variation in minutes and seconds.[45] In 1700 the Society published knowledge about navigation in the English Channel necessary for any ship sailing to the Atlantic, writing that ships had been mistakenly sailing north of the Scilly islands and up the Bristol Channel to the great risk of the ships, due to the change of variation on the compass, and 'the latitude of the Lizard and Scilly laid down too far Northerly by near 5 Leagues'. It argued that the Lizard is in 49°55', and the South part at 49°50' 'whereas in most Charts and Books of Navigation they are laid down to the Northward of 50 and in some full 50°'.[46] This sample of articles demonstrate the wealth of experiments related to solving question of useful knowledge in navigation and geography, and suggest that experimenters bought and knew how to use the requisite instruments to record magnetic variation at sea.

After the initial experimental years, the Royal Society expanded their role in supporting useful knowledge by promoting a limited number of exploratory voyages to collect geographical information including Edmund Halley's well-known voyage on the *Paramore* in 1698-1700. Halley was a Royal Society fellow and in 1698 was given control of an Admiralty ship to sail to the Atlantic and Pacific oceans to record variations of the magnetic compass and find longitudes of African and South American ports. Although the voyage was not completely successful, the Society later published his map of trade winds as well as other findings. Samuel Pepys praised the work, commenting 'may he not be said to have the most, if not to be the first Englishman (and possibly any other) that had so much, or (it may be) any competent degree...of the science and practice (both) of Navigation.'[47] As will be discussed in chapter 3, in the 1690s the Royal Society also reviewed publications of accounts of exploration voyages in the Southern Atlantic and Pacific by privateers William Dampier and Woodes Rogers and made them fellows of the Royal Society.

Influential fellows such as Henry Oldenburg, Nehemiah Grew and Robert Hooke maintained correspondence with men in colonies including Barbados and Jamaica. Some links were stronger, as some colonial officials later developed their career in the Royal Society, including John Vaughan who after acting as Governor of Jamaica in 1674-78, became President of the Royal Society in 1686-89. However, the work of Hans Sloane particularly exemplified the close links between the Royal Society and empire - he was not only a distinguished scientist, but was deeply embedded in the imperial project and gained much of his knowledge of

[44] 'A demonstration of an error committeed by common surveyors in comparing of surveys taken at long intervals of time arising from the variation of the magnetick needle, by William Molyneux' *PT* (1695), pp. 1695-1697
[45] 'Some observables about load-stones and sea-compasses', *PT* (1666), pp. 423-424
[46] 'An advertisement necessary for all navigators bound up the channel of England' *PT* Vol. 22 (1700-1701), pp. 725-726
[47] J. R. Tanner, *Samuel Pepys's Naval Minutes* (1926), p. 420

natural history and geography, which he became most well-known for, in Jamaica.[48] Sloane was a doctor appointed to work for newly-appointed Governor of Jamaica Christopher Monck in 1687, and after sailing from Plymouth, he sailed via Madeira, the Canary Islands, to reach Bridgetown, Barbados. The voyage continued via Nevis, Hispaniola, and finally reached Port Royal in December 1687, giving him wide experience of Caribbean geography. Monck died in 1688, and Sloane eventually returned to London in 1689.[49] His documentation of the region suggests that he understood and held practical useful knowledge and skills, and was able to carry out and judge experiments. His work and reputation as a natural philosopher partly depended on securing accurate geographical information, as well as establishing geographical knowledge as a valid empirical enquiry to be involved in.

Sloane used his experiences to write a detailed history of Jamaica published in 1707 that demonstrates his knowledge of the practical details of navigation and geography as well as his belief in the importance of communicating that information.[50] On the voyage to Jamaica from Plymouth in 1687, he was prevented by seasickness from making 'several experiments and observations', suggesting that he had taken with him the appropriate instruments and maps to make these observations.[51] Sloane was a connoisseur of maps, and described his search for maps in London of the first European voyages to the West Indies made by Bartholomew Columbus, brother of Christopher Columbus.[52] He explains Columbus's famous navigation error as the result of the geography of the West Indies, and explains that he thinks the map was 'probably a sea-chart of the Parts of the World then known; wherein those to the West were Ireland, the Azores, Cape Verd, and the Coast of Guinea'.[53] Regarding Jamaica he wrote that it 'lies in that part of the North Sea, which washes the East side of the continent of America […] It has many cayos, commonly called Keys, Shoals, and Rocks round it, whereby ignorant sailors are incommoded. It lies to the South West of England at about fifteen hundred leagues, or four thousand five hundred miles distant from it'.[54] He also described the position of the island in relation to other Caribbean islands and the Spanish American Caribbean coast. He described the latitudes of Spanish town, the longitude of the middle of the island (about 76), the length of the island (140 miles), and that it was fifty miles broad at its broadest place. His account also included maps of Jamaica and a chart of the Caribbean sea. The inclusion of this type of detail about the position of geographical features that navigators would need

[48] In 1707 Sloane published *A voyage to the islands Madera, Barbados, Nieves, St Christophers and Jamaica* (1707) with his observations of the natural history and geography of the region. Hans Sloane is a widely studied member of the Royal Society, known for his collection of documents and objects that still form part of collections in the British Museum and British Library

[49] Arthur McGregor ed., *Sir Hans Sloane: collector, scientist, antiquary founding father of the British Museum* (1994), pp. 11-35

[50] Kay Dian Kriz argues that the account was an effort to 'stabilise and naturalize a network of power relationships' in an age of English political instability. Kay Dian Kriz 'Curiosities, commodities and transplanted bodies in Hans Sloane's 'Natural History of Jamaica', *WMQ* 57:1 (2000), pp. 35-78, p. 37

[51] Hans Sloane, *A voyage to the islands of Madera, Barbados, Nieves, St Christophers and Jamaica* (1707), p. 3

[52] Ibid, p. *i*

[53] Ibid, p. *i*

[54] Ibid, p. *v*

to know suggests that Sloane had the skills to judge the quality of supplied information and that he believed it merited publication in England.

Sloane also described navigation conditions on the approach to Port Royal, which was a key trading node in the British American world. He wrote,

> a Bristol ship, coming towards Jamaica, struck on a rock two Miles from without the town of Port Royal, but this ship when lighted of the Goods was got off again. This is very ordinary, for the Rocks and Shoals being here-about covered with Coral and Coralline substances, the ships coming upon them, are not often pierc'd nor blug'd, but bruise these Coralline Substances to sand, and very often get off again without much damage.[55]

His suggestion that ships frequently hit these rocks two miles from Port Royal indicates the normality of difficult navigation, but also that navigators were still not fully aware of the scope of rocks and shoals in the harbour. It also indicates his familiarity with the nautical conditions at Port Royal and the importance he ascribed to understanding the navigation of the region. In 1694 he reported in *Philosophical Transactions* the aftermath of the earthquake that devastated Port Royal.[56] By this time, Sloane was a fellow of the Royal Society and his account was full of meticulous detail and speculations about the earthquake. He also included a chart of Port Royal keys and soundings, which he said would 'add much to these relations […] that part of Port-Royal which sunk was towards the Harbour sandy, and the sea adjoyning deep'.[57] His attention to information about this important town and harbour suggests that he was aware of the economic significance of the port for British trade.

Sloane also played a part in the market for information by buying printed books about navigation and geography, including 31 printed in London, including Robert Morden *Introduction to astronomy, Navigation, geography and other mathematical sciences* (1702), Edward Wright *Certaine errors in navigation* (1657) and Samuel Sturmy *A mariners magazine* (1684).[58] Sloane also collected maps, charts and atlases, including 13 of British colonies in the Americas published and sold by map-sellers in London. These included maps of Jamaica in Richard Blome *Description of island of Jamaica* (1672), John Seller's *Atlas Maritimus* (1690) and *Collection of charts* (1690), and John Thornton *Atlas Maritimus* (1710). He also owned copies of catalogues advertising globes, maps, instruments, mathematical books, and navigation by Philip Lea and other publishers in the 1700s.[59]

The work of Royal Society fellows and their associated circles did not take place in a vacuum. London was growing as a place where craftsmen, merchants, artisans and natural philosophers with their respective

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[55] Ibid, p. 1xxxv

[56] Hans Sloane and Alvarez de Toledo, 'A letter from Hans Sloane, M.D and S.R.S with several accounts of the earthquakes in Peru October the 20th 1687. And at Jamaica, February 19th 1687/8 and June the 7th 1692', *PT* Vol. 18 (1694), pp. 78-100

[57] Ibid, p. 80

[58] 'British Library Sloane Printed Books Catalogue www.bl.uk/catalogues/sloane' accessed April 27 2016

[59] Philip Lea, C*atalogue of globes, spheres, maps, mathematical projections, books and instruments* (1700); *A catalogue of valuable books in physick, mathematicks, navigation, books of maps, to be sold in the Strand* (1715)

knowledge sets met and mingled, and as a place that could provide the physical, cultural, economic and intellectual infrastructure to nurture and promote experiments and interest in useful knowledge. As highlighted by historians Larry Stewart, Jan de Vries, Nuala Zahedieh and others, London was not only a trade entrepôt but also a knowledge entrepôt acting as a 'clearing house of information'.[60] The sites of knowledge exchange extended from artisans' workshops such as the publishing businesses printing and selling maps and the Royal Exchange, to Wapping shops and docklands where information was bought and practiced, to coffee shops where information could be advertised and discussed, to institutional sites such as Royal Society, Gresham College, and Christ's Hospital, creating a community of learned practitioners in an environment of mercantile buzz and scientific curiosity that could be applied to imperial ambitions.[61] Adverts circulated in London newspaper for astronomy and mathematical lecturers in coffee houses, including the Swan coffee house used by Royal Society fellows, while Royal Society fellows and state figures like Samuel Pepys visited map-sellers shops to inspect publications and discuss the quality of maps.[62] These exchanges illustrate the extent of public exchange of information and the overlapping spheres of activity within the market for useful and scientific knowledge in London, suggesting that beyond the known activity of Royal Society fellows and in *Philosophical Transactions* publications, there were numerous other individuals interested in applying experimental methods and techniques using useful geographical objects to test and learn questions of geography and navigation that made use of the trade in maps, charts, books and instruments.

'Policymakers' and Committee of Trade and Plantations

A final area to consider in the market for useful knowledge are officials and state bodies managing the empire. The issuing of charters to individuals and chartered companies, and private financing of trade (with the exception of Jamaica in 1655) meant that much of the work of settling and exploiting the colonies was in the hands of settlers, plantation owners, merchants and mariners, limiting the extent of state control. Colonial government was through a combination of direct Royal rule (Caribbean), proprietary settlements (Carolinas, New York, and Pennsylvania), and chartered companies, however direct rule did expand through the course of the century.[63] Understanding the geography of empire was crucial to extending state control and exploitation of the colonies. Anne Godlewska, Neil Smith, Matthew Ederman and other historical geographers have analysed the relationship between geographical knowledge and empire in the 18th and 19th centuries and in

[60] Larry Stewart, 'Scientific and useful knowledge: London' pp. 325-345 in Patrick O'Brian ed., *Urban achievement in early modern Europe: golden ages in Antwerp, Amsterdam and London,* (Cambridge, 2001) p. 331

[61] Rob Iliffe 'Material doubts: Hooke, artisan culture and the exchange of information in 1670s London', *BJHS* 28:3 (1995), pp. 285-318; J.A Bennett, 'The Mathematicians Apprenticeship' BHJS, 18:2 (1985) pp. 212-218; Frances Wilmouth, *Sir Jonas Moore. Practical Mathematics and Restoration Science* (Woodbridge, 1993)

[62] In 1706 Robert Arnold offered astronomy and mathematics lectures at Swan Coffee-House in Threadneedle Street. Stewart, 'Scientific and useful knowledge' in O'Brian ed., *Urban achievement,* p. 338

[63] Michael J. Braddick, 'The English Government, War, Trade and Settlement, 1625-1688', pp. 286-308 in Nicholas Canny ed. *The Oxford History of the British Empire Vol 1: The Origins of Empire: British Overseas Enterprise to the Close of the Seventeenth Century* (Oxford, 1998). The chronology and geography of the extension of more direct rule is complicated, but historians tend to identify an increased role for English state in management of colonial affairs in the late 17th century

India, but links between early expansion of the American empire and geographical knowledge are less explored. The discussion uses Committee of Trade and Plantations account books, as well as the Blathwayt Atlas to highlight how state officials used maps and charts made by ordinary artisans for a commercial market to build their geographic understanding of British America.

The day-to-day affairs of the British colonies were managed by combinations of appointed Governors and local legislators or Assemblies, while the English state maintained administrative groups to oversee and understand the colonies. Conflict of authority of Crown and Parliament over the rights to regulate trade had caused political instability and civil war in the 1640-50s, however the Restoration in 1660 restored Royal authority to 'limit and regulate foreign trade'.[64] Although unresolved issues continued to provoke crises, including in 1679-81, the Crown 'embarked on an assertive colonial policy which sought to reshape imperial institutions in Crown interests'.[65] Charles II established a Privy Council committee for trade and colonies, with two parallel advisory groups for trade and colonies.[66] In 1670 an advisory group, the Council of Plantations was created, with ten regular members, expanding in 1672 to include trade duties.[67] In 1675 the Committee of the Lords of the Committee for Trade and Plantations replaced the Council, hiring Robert Southwell as secretary assisted by William Blathwayt.[68] It should be noted that the development of colonial administration from London in 1660-1720 was not a straightforward teleology of increased application of metropolitan resources to colonial governance. As A.K Steele notes, the War of Spanish Succession produced 'the untimely suspension of efforts to improve and extent royal government in the colonies', and the influence of the various committees were subject to domestic political fluctuations.[69]

Instructions issued to the 1672 Council of Plantations and Trade upon its formation advised to consider how 'Trade and manufactures may be more fitly and equally distributed through our Kingdoms'.[70] This involved developing a detailed understanding of the geography of the colonies – including harbour facilities, resources, population figures including distribution – and to 'procure exact Mapps, Platts or Charts of all and Every our said plantations abroad, togeather with the Mapps and Descriptions of their respective Ports, Harbours, Forts, Bayes, Rivers with the depths of their respective Channels'.[71] The Council bought maps and charts of the colonies both for private use in management, defence and exploitation of the colonies and public in the assertion of possession of territories. It also seems probable that individual members of the

[64] Nuala Zahedieh, 'Regulation, rent-seeking, and the Glorious Revolution in the English Atlantic economy' *EHR* 63: 4 (2010), pp. 865-890, p. 868.
[65] Ibid, p. 869. I.K Steele notes that Charles II increased Privy Council supervision of trade and colonial affairs. I.K Steele, *Politics of colonial policy* p. 4
[66] The institutional governance of the British Empire from London and the Board of Trade in particular is discussed by I.K Steele. Ibid
[67] Ibid, pp. 4-6
[68] Winfred T. Root, 'The Lords of trade and plantations, 1675-1696' *The American Historical Review*, 23: 1 (1917), pp. 20-41
[69] Steele, *Politics of Colonial Policy*, p. xiv
[70] Ibid, p. 7. C.M Andrews argues that since no instructions were issued to subsequent committees Lords of Trade (1675) and Board of Trade (1696), the instructions issued in 1672 formed the basis for later work and as such can be considered a guide to the work carried out by the Lords of Trade and the Board. Charles M. Andrews, *British committees, commissions and councils of trade and plantations, 1622-1675* (Baltimore, 1908) p. 108
[71] Ibid, p. 22

committees collected maps of the colonies in order to inform their own understanding of the colonies, which may have been as many as 130 individuals.[72]

A detailed understanding the scope of settlement and exploitation of colonies such as Jamaica and Barbados could help the Council determine potential for further economic extraction. In cases like the middle colonies of North America and the Carolinas, where potential for further exploration and settlement were much greater (Barbados was rapidly planted and populated), understanding the geography (including rivers, mountains, coastlines) could help statesmen to determine the economic potential in further expansion.[73] The Council of Trade also had wanted to understand the number of plantations and settlements established to ensure they were securing an appropriate amount of revenue. Zahedieh argued in relation to the Atlantic institutional framework that 'England's political classes united to assert that it 'was a matter of justice' that any benefits to shipping, trade, and entrepôt activity should be reserved for the mother country'.[74] The same philosophy applied to the question of securing a cut of the profits of empire for the English State and senior members of England's political class.[75] Efforts to extend the Crown's understanding of colonial geography corresponded with this campaign to ensure that profit and gain cushioned by distance and ignorance did not disappear. State officials did not just want to understand more about empire – where it was, what the resources were, who controlled what – but they wanted to improve their control and governance of it to ensure that outputs were being directed as much as possible towards improving the affairs of the nation.

A related aim was the desire to curb colonial ambitions for greater independence and ensure loyalty from colonists to England, specifically the Crown. This was intensified by the Crown's desire to prove the power of the Royal prerogative over the colonies. Bacon's rebellion in Virginia in 1676 and instability surrounding the Glorious Revolution 1689 highlighted the vulnerability of the State to colonial organising and ambitions, while in Jamaica, groups of escaped enslaved people living in Maroon communities in the Blue Mountains (the highest mountain range in the Caribbean at 2,256m elevation) and in St George's Parish threatened to disrupt English control.[76] Demonstrating greater geographical understanding of the colonial

[72] The Councils of Trade and Foreign Plantations had 67 and 48 members respectively, with a cross-over of 28 members. The Council of Plantations had 10 regular members and five additional office-holders, including John Evelyn. The Lords of Trade committee had 21 members. The Board of Trade (1696) had eight regular members

[73] The case of opening up of Crown Lands to planters in Jamaica in 1664 and the instruction to Governor Thomas Modyford to record the location and allocation of land highlights this relationship between economic exploitation, geography and mapping. Michael Craton and James Walvin, *A Jamaica plantation: the history of Worthy Park 1670-1970* (Toronto, 1970) p. 20. Land scarcity in Barbados by the 1660s and 1670s led some settlers to seek opportunities elsewhere in the Americas including the Carolinas, leading to the first permanent settlement in South Carolina in 1669 by Anthony Ashley Cooper. See Robert M. Weir 'The Carolinas' in Canny, *Origins of Empire Vol. 1*, pp. 375-397

[74] Zahedieh, *The capital and the colonies,* p. 35

[75] There is an extensive literature about early modern mercantilism, including the growth of the Dutch Republic. See Charles Wilson, *Profit and power: a study of England and the Dutch wars* (1957); David Ormrod, *The rise of commercial empires: England and the Netherlands in the age of Mercantilism, 1650-1770* (Cambridge, 2003); Philip J. Stern and Carl Wennerlind eds., *Mercantilism reimagined: political economy in early modern Britain and its empire* (Oxford, 2014)

[76] Braddick points out that following the rebellion, royal Governors were required to seek permanent revenue that would free them from dependence on the legislature. Michael J. Braddick, 'The English government, war, trade and settlement, 1625-1688' in Canny ed., *Origins of Empire Vol. 1*, p. 299; Richard S. Dunn, 'The Glorious Revolution and America' in Canny ed., *Origins of Empire Vol. 1*, pp. 445-466. The Maroon communities were formed by people who had escaped slavery, either from Spanish plantations in 1655 when English forces invaded the island, or subsequently from English plantations, including significant rebellions in the 1670s-90s. Campbell argues that within a year of English invasion, British authorities believed the

environment could further bolster the legitimacy of claims to hold a Royal prerogative over trade and the colonies, and printed maps displaying Royal imagery circulated in London also played a role in asserting Royal prerogative.

Threats to the integrity of empire also came from shifting balance of power amongst European nations and ambitions to seize new territories, as well as clandestine trading. Incursions by foreign powers remained a constant source of concern, and attacks on Jamaica in 1658 by Spanish forces illustrate that this was not just paranoia. The length of the Jamaican coastline is just over 1000km, and in the majority of this period, it remained largely unsettled by English colonists. In 1697 Governor William Beeston wrote to the Board of Trade regarding the appointment of a new surveyor, 'besides, the country is so large and has so many harbours, bays and rivers to land at that it can only be fortified by men'.[77] The seizure of Hudson's Bay factories by the French during King William's War, and the years of privateering and illegal trade in the Caribbean highlight the uncertainty of English territorial and commercial holds in this period.[78] Understanding the vulnerabilities and strength of coastlines, places where enemy ships could hide, locations for fortifications, and topographical barriers or advantages to invasions and defence could all play a role in enabling the State to plan and target resources to defend the colonies and their trade.

The desire to defend the colonies against European rivals was linked to a fourth use for imperial maps. The Council of Trade wanted to assert British possession and control of colonial territories, particularly in the contested region of the Caribbean, and to a lesser extent, parts of North America.[79] Instructions issued to newly-appointed Governor of Jamaica Thomas Windsor in March 1662 illustrate how the Council of Trade perceived the importance of being seen to develop colonies to demonstrating control and ownership of the island. Windsor was told to 'order an exact survey of all harbours and landing places, and erect necessary fortifications, and as well for the bearing of such like expenses as for a mark of our sovereignty in and over the said islands'.[80] These instructions were issued just seven years after the English seizure of Jamaica from the Spanish, and the island was considered to be particularly vulnerable to attack. In 1670 the Treaty of Madrid granted the colony to England if it could demonstrate possession. The first detailed printed map of Jamaica

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Maroons to be a greater threat than the Spanish, and by 1700 were considered 'considerable' and 'remarkably prolific' by contemporaries. Mavis C. Campbell, *The Maroons of Jamaica, 1655-1796: a history of resistance, collaboration and betrayal* (Granby, Mass., 1988), pp. 14-43

[77] Calendar of State Paper, Board of Trade, 8, Nos. 64, 64 I, National Archives, Kew, UK. Correspondence from colonial Governors should be read in the context of repeated requests for higher budgets to be directed towards the colonies, however Beeston's point about the many coves and bays on the Jamaica coastline highlights the weaknesses of the island to attack

[78] Nuala Zahedieh, 'A frugal, prudential, and hopeful trade: privateering in Jamaica, 1655-1689', *Journal of Imperial and Commonwealth History*, 18 (1990), pp. 145-68; Nuala Zahedieh, 'The merchants of Port Royal, Jamaica, and Spanish contraband trade, 1655-1689', *WMQ*, 3rd ser., 43 (1986), pp. 570-93.

[79] Lauren Benton argued that in the early modern Atlantic, 'Mapping was another technique for demonstrating possession. Settlements, including forts, were equally important symbols, both demonstrating an intent to occupy and serving as evidence of actual possession.' Lauren Benton, *A search for sovereignty: law and geography in European Empires, 1400-1900* (Cambridge, 2010) p. 56. Lesley B. Cormack argued that use of geography to construct and legitimise an English state stretches back to the 16th century. Lesley B. Cormak, 'The fashioning of an empire: geography and the state in Elizabethan England' in Godlewska and Smith, *Geography and empire,* pp. 15-30

[80] Calendar of State Papers, Col. Entry Bk., No.92, pp.37-56, and No. 27, pp. 13-19

was published by John Ogilby in 1671. It included a table listing plantation owners and crops (see figure 2).[81] Ogilby's map was not decorative in comparison with the double-hemisphere maps or world maps in the style of William Blaeu or William Berry.[82] It had a simple cartouche and title, with little pictorial decoration. The image shows Jamaica as relatively unpopulated, but crucially, not unexplored. Place names are marked along the coastline and 11 of the 13 parishes have English names, whilst the three southern and most populated coastal parishes showed significant density of settlement, plantation and rivers detail. The presentation of Jamaica as explored, with the establishment of plantation crops, and bearing English place names put a stamp on the island as distinctly English to the viewer.[83] It also indicated to potential settlers and investors in England that, at a time of growing population and falling real wages, there was a new colony with thousands of acres of land available for settlement and cultivation that could emulate the sugar successes of nearby Barbados.[84]

[81] Ogilby, *Novissima et acuratissima Jamaicae*
[82] Geoff Armitage and Ashley Bayton-Williams, *The world at their fingertips: eighteenth-century British two-sheet double-hemisphere world maps* (2012)
[83] Benjamin Schmidt discussed the use of maps by Dutch colonial officials to demonstrate possession in New Netherland in the early seventeenth century. Schmidt, 'Mapping an empire: cartographic and colonial rivalry in seventeenth-century Dutch and English North America' *WMQ* 45:3 (1997) pp. 549-578
[84] Sugar production in Barbados had expanded significantly between 1646 and 1652. In 1668, the value of sugar imports to London from Barbados had reached £329,129.8. Nuala Zahedieh, 'London and the colonial consumer in the late seventeenth century', *EHR,* XLVII, 2 (1994), pp. 239-261

Figure 12: John Ogilby, *Novissima et accuratissima Jamaicae descriptio per Johannum Ogilium* (1671)

Original in the John Carter Brown Library at Brown University

Some of these demands for knowledge could be met by manuscript information supplied directly from colonial Governors or other contacts to Council members.[85] In 1699 Edward Randolph wrote to the Board of Trade that he was sending a map with useful information: 'I enclose a draft of the town and castle of St. Augustine, with a short description of it by a gentleman who has been often there. It's done exactly true, more for service than for show.'[86] He emphasised the draft's value by reference to the eyewitness authority of a gentlemen who he claimed had visited the town, and he foreground its utility - 'for service' – over its value in aesthetic display. The Council also appears to have bought maps from mariners, as was the case in November 1677 when a map of Newfoundland was bought from a ship's master.[87] Council members Robert Southwell

[85] The colonial papers at the National Archives reveal multiple instances of requests for surveys and mapping information – or 'raw data' - from colonial Governors. Although in some instances it is possible to identify links between manuscript material sent to Lords of Trade and subsequent maps published in London, on the whole this aspect of the collection of geographical information is outside the remit of this chapter which focusses on demand for printed information in London

[86] Calendar of State Papers, Colonial Papers, Vol.17 March 1699, National Archives, Kew, UK

[87] 'Plantations Committee expenses', BL Add. MS 9767, f. 31

and William Blathwayt also collected a library of maps, charts and books. Records of the Lords of Trade and Plantations Committee expenses include purchases of maps and charts of the value of around £148 between 1678 and 1696, as seen in figure 11.[88] If maps and charts were bought at average costs advertised in newspapers of around 2s, this would have been around 1500 maps. In the early years of the Committee, they bought geographical books about the Americas, including Hakluyt's *Relations of the West Indies* and John Ogilby's *History of the Americas*, indicating that these accounts were not only for leisurely gentlemen but that state officials believed they contained relevant information. The majority of maps were purchased from stationers, which suggests that they were printed, while 18 of the maps mentioned in the accounts were of maps 'drawn by hand'.[89]

Figure 13: Selected maps, charts and books purchased by the Council for Trade and Plantations, 1678-1696

Year	Item	Cost
11 July 1676	A map of Newfoundland in vellum which was his [Henry Slingsby] own'	£1.10s.6d
11 July 1676	Payment to John Seller for Atlas Marine being a book of maps	£1
11 July 1676	Payment to John Seller – map of Virginia	6s
11 July 1676	Payment to John Seller – map of His Majestys dominions in America	12s
11 July 1676	Payment to John Seller – Mercator map of the West Indies	12s
11 July 1676	Payment to John Seller – chart of the West Indies	15s
11 July 1676	Payment to John Seller – large chart in 16 sheets of maritime coast of America	£1.10s
11 July 1676	A small map of the world upon cloth	5s
11 July 1676	Mr Ogilby's History of the Americas	£2.5s
11 July 1676	The world in two sheets	2s
11 July 1676	Smiths voyages	5s
11 July 1676	Description of Amerique, 2 vol	7s
11 July 1676	Hackluyts Relation of West Indies	10s

[88] 72 of 104 purchases were referred to as 'For stationary ware as paper, pens, ink, wax, tape, books, mapps, binding of books', making it hard to calculate the exact amount the Committee spent on maps. One-eight of the total amount spent on 'stationary ware' was £148. 'Plantations Committee expenses'
[89] Ibid

11 July 1676	Ligons history of Barbados	5s
11 July 1676	Natural history of the West Indies	4s
31 March 1677	For the history of the Antilles, in French	£2
31 March 1677	To the mapman for pasting Jamaica and Newfoundland upon cloth a map of England, and mending some maps	£1.6s.6d
31 March 1677	For a large map of the world	16s
20 November 1677	For a large map of the streights, maps of Barbados, Maryland, Virginia, and Carolina drawn with the hand; together with a map and description of Newfoundland bought off a master of a ship by order of the Committee	£12.16s
5 January 1677	For descriptions of Madagascar in French	3s
25 March 1678	For several maps of the plantations viz New England, New Jersey, Jamaica, Leeward Islands, Newfoundland	£13.17s.3d
25 March 1678	For several history, journals, descriptions and voyages, relating to trade and the west indies out of Holland	£10.10s.10d
25 March 1678	For several books of maps, histories and voyages, relating to the east and west indies, out of France	£2.15s
30 July 1678	For several books and maps relating to trade and plantations brought out of France	£39.7s.11d
28 November 1678	For ten maps of the east indies drawn by hand and several maps of the West Indies	£8.18s
24 June 1679	For a map of Bermudas, two maps of the port of Boston in New England, a Map of Caroline, Long Island and parts adjacent	£4.6s
11 October 1680	For severall mapps drawn by the hand of Gambia, Carolina, Guinea and of the Mediterranean	£5.7s

The colonial geographical coverage of the maps included the Carolinas in October 1680; New England and Long Island in 1679; New Jersey, Jamaica and Newfoundland in 1678, and Virginia in 1676. The Committee also bought information focussed on smaller areas of trading interest, for examples Boston port and Long Island. In 1680 the committee spent £5.7s on maps of Gambia and Guinea, where the British slave trade on the West African coast was concentrated. They also bought maritime charts and atlases – in 1676 they paid £1 John Seller for 'Atlas Marine being a book of maps', which may have been Seller's *Atlas Maritimus* published one year earlier. They bought charts of the West Indies and a chart of the coast of America from Seller, which were probably *A chart of the West Indies from Cape Cod to River Oronoque* (1676). John Seller was an important

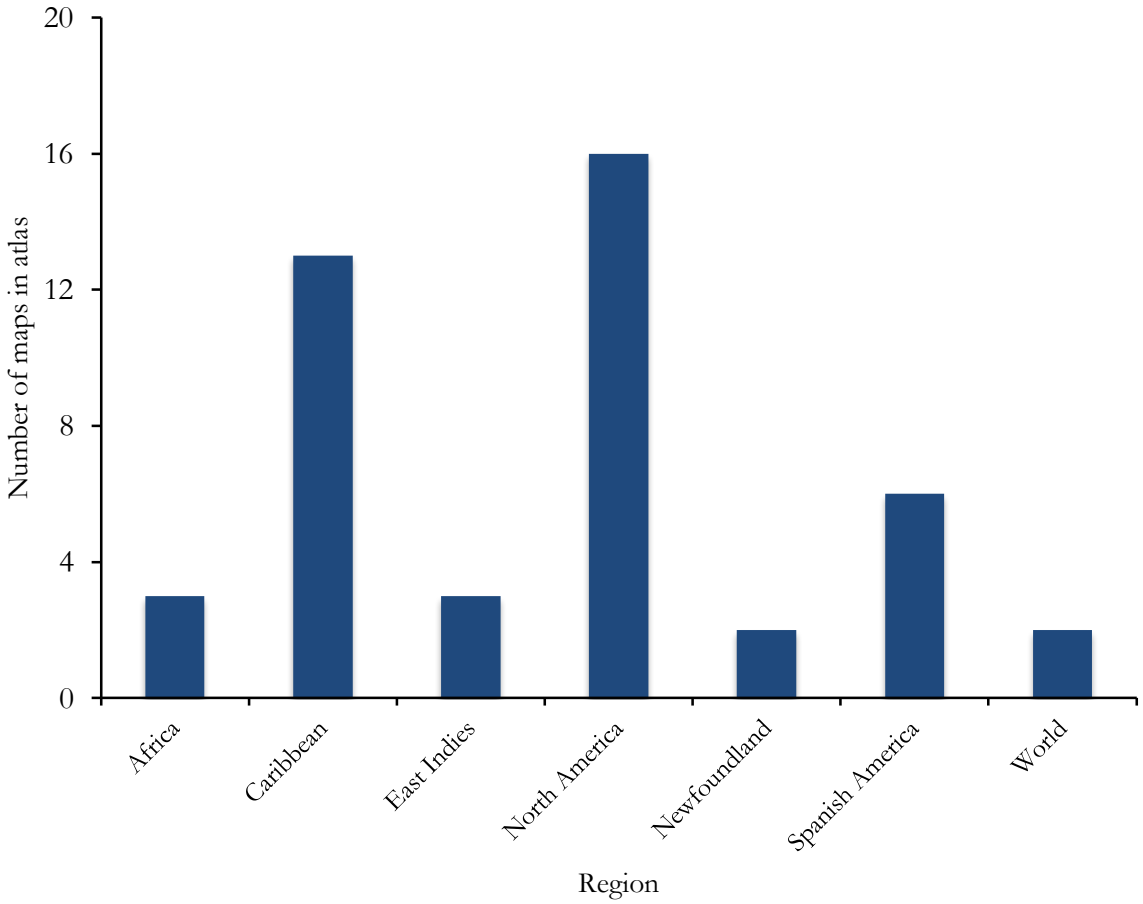
supplier to the Committee, highlighting that as in the case of the Royal Mathematical School, Seller was considered to produce and sell items of sufficient quality to inform officials of state working for the Crown.[90]

The maps were used in display and for consultation, which places them in a different environment for use than maps and charts bought by mariners and educators of mathematics. On 21 January 1678 a payment was made for 'pasting twelve maps onto boards' suggesting that some maps were selected for closer and more regular inspection, as well as perhaps for display in the Plantation Offices.[91] This mounting of the maps onto boards indicates an environment of utility that involved members of the Committee probably standing over selected maps or observing them on a wall, examining precise detail or making decisions based on the geographical view gained from these maps. In March 1677 the Committee paid 'the mapman' for pasting maps of Jamaica and Newfoundland onto cloth, indicating further evidence of preservation of maps in styles commonly associated by historians with practices of luxury consumption, but were instead to enhance the maps for improved and longer-lasting practical use.[92] It suggests that methods of display and preservation of maps and charts did not always render them as objects for inactive display or status, but that work to enhance maps through pasting them on boards could also be an act of creating utility, and further indicates the cross-over between actions of craftsmen who printed the maps, joiners who created and mounted the boards, and political elites who used the final results to make decisions about empire.

The Committee's collection of maps has since disappeared or been dispersed into other collections, however one group survive in the Blathwayt Atlas, assembled by Secretary to the Committee William Blathwayt around 1683. The Blathwayt Atlas has been discussed by Jeannette Black, who argued that it was the 'first management tool of empire'.[93] It consisted of 48 maps and charts - 38 printed and 14 manuscript. The geographical coverage was global but with a significant focus on the Americas, as seen in figure 12. North America dominated, including 16 maps of the middle colonies and 14 of the Caribbean. The attention to maps of the Caribbean, which is dwarfed in area by North America but was the most lucrative region of the empire in the late-17th century, indicates Committee priorities in exploiting the riches of the Caribbean colonies by way of understanding them.

[90] Seller was the only map seller referred to directly by name in the accounts
[91] £16.8s was paid for 'pens, ink, sand, wax, tape, and binding of books and pasting twelve maps upon boards' on 21st January 1678. 'Plantations Committee expenses'
[92] Ibid
[93] Jeanette Black, 'The Blathwayt Atlas: maps used by British colonial administrators in the time of Charles II' *Imago Mundi,* Vol. 22 (1968), pp. 20-29

Figure 14: Regions included in the Committee of Trade and Plantation Blathwayt Atlas c.1683



The content of the maps varied. Some included close topographical detail, such as individual settlements and plantations on Bermuda Islands on a manuscript map using Richard Norwood's survey in 1663. The land was divided by lines into plots, with houses drawn numbering the settlements. The island regions were divided and named, such as Tuckers towne in the east and Devonshire Tribe in the centre. Southampton harbour had islands and ten rocks marked, indicating that it was a large harbour dotted with small islands and rocks necessary to navigate. Other maps had broader geographical coverage, such as *A new mapp of the world according to Mr Edward Wright commonly called Mercator's Projection* which showed the world with the Atlantic Ocean at the centre of the map and dense details on European and American coastlines.

The printed maps were published between 1640 and c.1683, when the atlas is believed to have been compiled. The age range of the maps and the number of printed maps indicates that the majority, if not all, were not commissioned for the Committee. The copy of map *To Capt. John Wood this map of the world drawn according to Mercators projection* in the atlas did not have additional dedications or information related to the Crown or the Committee that might be added if the item was made to commission. Some maps in the atlas were also

available on the commercial market, indicated by their advertisement in the *Term Catalogues* and *London Gazette.*[94] At least 28 of the printed maps were advertised in an open market or could be bought from publishers in France or the Netherlands.

Evidence from the state of the maps also suggests that the Committee did not invest in the most up-to-date information or commission printed maps. John Seller's map of Tobago in the atlas included a dedication to Royal Physician Hugh Chamberlan who had fallen out of favour with the King, rather than the updated version produced by Seller without this dedication. This suggests that the Committee did not prioritise replacing maps with updated versions.[95] John Seller's publication of a subsequent edition indicates that Seller did not produce the Tabago map exclusively for the Committee, and was free to sell the same image of Tobago to other consumers. This suggests that either the Committee did not have the desire or monetary capital to invest in commissioned maps. However, the high level of colouring on the maps – 16 of the 35 engraved maps were hand-coloured, including full colour as well as outlines, and 9 of the 11 manuscripts maps were coloured – indicates that additional work was done to the printed maps to prepare them for the Committee. Manuscript maps were drawn in varying styles. The maps of Newfoundland and the Middle Colonies (six in total) were similar to maps drawn by William Hack/James Lancaster, with same lettering style, design of compass rose, and colour scheme. The map *Long Iland by Robertte Ryder* was drawn with different lettering style, finer lines around the coastlines of Long Island without colour and a more elaborate compass rose, reflecting the individual style and training of the maker. Although these maps may have been bought pre-prepared from sellers or were second-hand, the intensity of work required to produce a single manuscript map compared to printed maps indicates that for some of the atlas, a significant amount of individual artisanal work was required.

Fifteen maps were published by French or Dutch makers, including *Les Isles Antilles* (c.1656) by French map-maker Nicolas Sanson and *Accuratissima Brasiliae Tabula* by Jan Jansson (c.1640). All 15 maps were of non-British colonies. This suggests that the Committee could not meet all of its requirements from London makers, and that for non-colonial regions, non-English makers were considered superior. However the publication dates of the French and Dutch maps were earlier than the English-made maps, which were mostly published from the 1670s onwards, and the regions covered in the maps were largely outside of the direct British colonial sphere. This suggests that as the century progressed, English makers become better able to produce quality maps and charts, particularly in regions of direct English imperial importance.

The range of suppliers of maps highlights the use of commercial publishers by the committee, rather than hiring map makers or publishers that exclusively worked for the Lords of Trade. This highlights the breadth of financial support that publishers relied upon, as well as the diversity of consumers and patrons their

[94] Tyacke documented 400 surviving map adverts in the *London Gazette* 1668-1719. Tyacke, *London map-sellers,* p. *xx*
[95] This is described in detail by Black 'The Blathwayt Atlas'

work had to satisfy. It indicates the range of imperial activities that map publishers and artisans were involved in – as well as producing items that promoted empire through encouraging settlement and trade, and producing items that ostensibly aided in the navigation and exploration of settlements and oceans, they also provided items that aided the official, state-led management of empire, providing a geographical basis for the decisions made by colonial officials at the heart of government about how to exploit empire and markets.

Management of empire was not only the concern of the Lords of Trade. Other individuals, or 'policymakers', who were usually part of the social and political elite, had financial and political investment in the development of the British empire. In 1680 John Evelyn visited Whitehall and saw 'aboundance of mapps & sea-charts: entertainments & pomps; buildings, & pieces relating to the navy'.[96] Obtaining geographical information about empire could improve their understanding of the colonies and the type of land and crops with potential economic output for individuals able to invest in empire. There was also a political aspect, as Whig and Tories sought to ensure that the fruits of empire and the pace of colonisation suited their political and social agendas. These people acted as a source of demand for geographical information and objects in London.

The most obvious example of a 'policymaker' is Samuel Pepys, whose biography is familiar to early modern historians. As a prominent member of the London political and social elite, he had wide ranging interests, including in natural philosophy and naval affairs, which were reflected in his appointments as Clerk of the Acts of the Navy Board in 1660 and as a Fellow of the Royal Society in 1665. He was later made Secretary of the Admiralty and President of the Royal Society in 1684-86, and was a Governor of Christ's Hospital. He was an avid collector of books, and to a lesser extent, of maps and geographical objects, which highlight his role as someone deeply involved in the nation's affairs in the market for useful knowledge in London. His navy responsibilities and interest in maritime affairs gave Pepys an interest in the improvement of English navigation techniques, leading him to invest in searching for knowledge and practices that would boost the nation's capacities for navigation and therefore its naval-related abilities in empire and trade.

Pepys was a regular visitor to map sellers' shops in London, suggesting that this was a relatively common feature of the lives of prominent political and social elites. Pepys's private collection contained at least 1100 maps and charts, including John Lederer's map of Virginia (1672) and John Narborough's account (1694).[97] In 1661 Pepys recorded that he 'walked out to the Stacioner's and looked over some maps and pictures for my house'.[98] This suggests that the trade was both large enough and socially significant enough to support

[96] E. S. de Beer, *The Diary of John Evelyn* (Oxford, 1955), p. 26
[97] Sarah Tyacke, 'Samuel Pepys as map collector' in Robin Myers and Michael Harris eds., *Maps and prints: aspects of the English booktrade* (Oxford, 1984) p. 2. Tyacke points out that this number is based on the extant collection, and that the contemporary collection was probably even larger. John Lederer, *The discoveries in several marches to Virginia* (1672)
[98] Tanner, *Samuel Pepys's,* p. 326

this, and that the interests of active statesmen like Pepys was a part of sustaining the trade. John Evelyn, another member of the Royal Society and active member of the London social and political elite, recorded visiting some of the booths or stalls selling maps in Westminster.[99] Pepys had commercial relations with a wide range of map and chart publishers including with John Seller for sea atlases and charts; Richard Mount for navigation books and sea atlases; William Berry, and with chart-makers based on the Thames John Burston and John Thornton for manuscript charts.[100] Sarah Tyacke pointed out that Pepys largely collected English maps and charts, in particular from John Seller, and did not choose to collect Dutch sea atlases, although he did maintain dealers in Rotterdam.[101] Although patriotic duty to support the English trade may have partly motivated Pepys's buying habits, it seems unlikely to have wholly trumped sourcing high quality geographic or navigational information, suggesting that objects bought from English sellers were of sufficient quality, and that the skills existed in the English trade to produce and procure maps and charts worth buying. Pepys had a close relationship with some map publishers, and sourced specific maps or charts. In 1695 Pepys noted that he wanted 'to enquire of Mr [John] Seller for his Arcando del Mare & if hee has it still to borrow it'.[102] Arcando (Arcano) del Mare was a sea atlas made by English map-maker Robert Dudley first published in 1645 in Florence, and contained several maps of the West Indies. Pepys's interest in borrowing from Seller a copy of this significant but probably rare atlas, initially published in Florence, indicates Pepys's commitment to expanding his geographical and cartographic knowledge, as well as the intimate relationship he had with the map selling community.

In some cases Pepys had a direct role in commissioning information. His motivation seems largely to ensure that information about the British coastline, as the route taken out by all ships leaving Britain including to the Atlantic and Pacific trades, was accurate and useful to mariners. In 1693 Pepys asked chart-maker John Thornton to compare the depiction of British coastlines in the French sea atlas the *Neptune Francis* with the recently-produced English coasting pilot by Greenvile Collins.[103] He paid Thornton from his own pocket to 'to see what can be gathered of useful on that subject and particularly the influences to be made therefrom concerning the Trinity House among whom Collins is a younger brother'.[104] Pepys's concluded that the work was unsatisfactory and he criticised Trinity House for allowing a 'private and single' person to complete the project.[105] This frustration at the private nature of production and that the state or a sanctioned institution was not carrying out the work further highlights a limitation of the commercial market for useful geographical knowledge.

[99] de Beer, *Diary of John Evelyn* p. 2616
[100] Tyacke, 'Samuel Pepys', p. 20
[101] Pepys used Joseph Hill in Rotterdam and his nephew John Jackson as dealers. Tyacke, 'Samuel Pepys', p. 13
[102] Ibid, p. 14
[103] Ibid, pp. 15-16
[104] Tanner, *Samuel Pepys's,* pp. 324, 391
[105] Chapell, *Tangier Papers*, p. 108

The efforts of policymakers show the perceived need for geographical information to manage empire. It indicates that mathematical and geographical skills were in demand in London, and that the output of sellers like John Seller, William Berry and John Overton were valued by state officials, including Samuel Pepys. The Committee of Trade and Plantations had little ability to construct, manage or commission large-scale and systematic information collection of the style conducted by imperial institution in Spain or by chartered companies like the East India Company or Dutch VOC and instead solicited information from colonial Governors, and bought maps and charts from sellers in London. The result was largely piecemeal - the main colonial atlas in their collection consisted of maps and charts produced on a commercial market for general sale, with little uniformity of style or contents. Individuals like Samuel Pepys developed a personal and individual interest and expertise in maps and charts, and combined with the interests and careers related to the nation and empire, he spent time buying maps, talking with sellers, and offering critical evaluations about quality.

The application of useful geographical knowledge by craftsmen, tradesmen and gentlemen engaged in natural enquiry and statecraft to imperial expansion and management demonstrates how the growing empire encouraged the simultaneous growth of the information market. Mariners, merchants and gentlemen bought maps, charts and instruments to inform their understanding of empire which contributed to their decision-making about how best to exploit it. Many of these objects were sourced, and to a growing extent produced, in London, as it also became a trade entrepôt. In addition to using this useful geographical knowledge, mariners and merchants collected information as part of the circuit of knowledge production and application in the empire. This collection and the human capital involved is the focus of the following section.

Chapter 3: John Narborough in the Straits of Magellan 1669-1671

In 1707 Nathaniel Uring sailed the eastern Caribbean to find places where he could trade with Spanish merchants. He replenished their ship at Tolú, 100km south of the key Spanish port Cartagena, before arriving at Isla Baru which he described as 'the place where we lay to trade with the Merchants of Carthagena'. According to Uring, Baru was usefully located for English merchants aiming to tap into Spanish American trade - 'this place is about eight miles from the City, and a good Road for vessels to ride in'.[1] His testimony highlighted that interest of English mariners and merchants in finding weak links in the Spanish American trade network and how, although trade was legally restricted between the nations, European merchants in the late-17th and early-18th centuries circumvented convention by exploiting the complex geography of the region.

By the 1670s England was asserting itself as a global economic and political player. The seizure and exploitation of colonies in Barbados, Jamaica, the Carolinas and others altered the constitution of English overseas trade with growth of imports and re-exports of colonial commodities like sugar, tobacco and calicoes.[2] At the same time, English elites turned their eyes to the glittering fortunes they believed could be made in Spanish America as the traditional dominance of Dutch traders weakened and other European players entered the ring.[3] Spain's weakening monopoly had allowed inter-regional trading to develop, leading to the emergence of what J.H Elliot describes as a 'partially autonomous Hispanic American economy'.[4] This included a north-south axis along the Pacific Coast from Acapulco, running south to Lima and parts of Chile. Nuala Zahedieh argues that 'by the mid-seventeenth century, it appears that the bulk of Spanish American trade was in the hands of foreigners'.[5] European interest in Spanish America was two-pronged: silver and slavery. In the Spanish Caribbean alone, bullion production averaged 8 million pesos annually between 1696 and 1700, compared to 7.6 million pesos in total output in non-Hispanic possessions.[6] Silver was the most valuable primary commodity produced in Spanish America, and mines was concentrated in northern Mexico and at Potosi.[7] Silver was traded by Spanish merchants in trans-Atlantic firms operating from Seville, or for textiles and silks imported from East Asia via Manila.[8] Silver mined largely by enslaved indigenous populations was transported to Acapulco,

[1] Nathaniel Uring, *A history of the voyages and travels of Capt. Nathaniel Uring. With a new draught of the bay of Honduras* (1725), p. 166
[2] W.E Minchinton, *The growth of English overseas trade in the seventeenth and eighteenth centuries* (1969), p. 82
[3] The next English conquest in the Americas after Pennsylvania was the 1732 settlement of Georgia. Johannes Postma, *The Dutch in the Atlantic slave trade* (Cambridge, 1990), pp. 26-55
[4] J. H Elliot, *Empires of the Atlantic World: Britain and Spain in America 1491-1830,* (New Haven, 2007), p. 227. Until 1580 only Spanish vessels had legally been allowed to enter Spanish American ports. After the union of Spanish and Portuguese crowns in 1580, Portuguese vessels could enter ports, but after the breakdown of the union in 1640, Spanish American ports became open to traders from other European nations
[5] Nuala Zahedieh, 'The Merchants of Port Royal, Jamaica and the contraband trade, 1655-1692' *WMQ*, 3rd series, 43 (1986), pp. 570-593, p. 572
[6] Alex Borucki, David Eltis, David Wheat, 'Atlantic history and the slave trade to Spanish America' *The American Historical Review* 120:2 (2015), pp.433-461, p. 435
[7] James Lockhart, Stuart B. Schwartz, *Early Latin America: a history of colonial Spanish America and Brazil* (Cambridge, 1983), pp. 146, 153
[8] The silver trade via Manila is a core feature in debates regarding the origins of globalisation and global trade. For an introduction to the debate, see Dennis O. Flynn and Arturo Giraldez 'Born with a 'silver spoon': The origin of world trade in 1571' *Journal of World History* 6: 2 (1995), pp. 201-221

where galleon ships transported them east to Manila to be exchanged for textile cargoes for export to European markets.

Production of export commodities such as cacao and pearls in Venezuela and hides in Rio de La Plata as well as gold mining in New Granada, and products for colonial markets like sugar and cacao relied on enslaved labourers.[9] Between 1581-1640 Spanish ships transported almost a quarter of a million people from Africa, compared to a combined 200 on other European ships to North America and British, French and Dutch Caribbean. However, between 1641-1700 arrivals of enslaved Africans on Spanish ships reduced to 21,700, and to just 300 in the first 60 years of the 18th century.[10] This collapse did not end the transportation of enslaved people to Spanish America - from 1641 onwards 118,500 people were transported, probably significantly more if contraband trade is taken into account.[11] At the same time, French and British trade in enslaved people skyrocketed - 1.3m enslaved people were transported to British America and the Caribbean between 1641 and 1760, and almost 0.5m to the French Caribbean - indicating the expansion of British and French capacity to operate in the trade.[12] Inter-regional trade in the Americas enabled the transportation of slaves to Spanish America, and operated from three major branches - Dutch trade from Curacao, English trade from Barbados and Jamaica, and a third from Brazil to Rio de la Plata.[13] The English joint-stock company Royal African Company enjoyed a monopoly on English trade on the west coast of Africa and to American colonies from its founding in 1672 until a campaign by 'independent traders' opposing the monopoly successfully deregulated the trade in 1712.[14] Most of this trade was to the British Caribbean, but perhaps as much as 50% of cargoes were sold to Spanish traders in the 1680s.[15] There was growing awareness in England of the potential of tapping into Spanish American markets if England was granted the prized lucrative *asiento* contract by Spain to trade in enslaved people.[16] In the 1670s and 1680s Dutch traders held the contract, before it was passed to the Portuguese in 1690s and to the French during the War of Spanish Succession.[17] Some British trade to Spanish America took place before 1712 through contraband traders operating from Jamaica and selling enslaved people, European manufactures to Spanish traders and exporting logwood amongst other products.[18] In 1670 the Treaty of Madrid between England and Spain hinted that licenses for trade between the two nations might

[9] William Frederick Sharp, *Slavery on the Spanish frontier: The Colombian Chocó, 1680-1810* (Norman, Oklahoma, 1976); Frank T. Proctor III, 'Afro-Mexican slave labour in the Obrajes de Paños of New Spain, seventeenth and eighteenth centuries' *The Americas* 60:1 (2003), pp. 33-58
[10] Borocki, Eltis, Wheat 'Atlantic History', p. 440. 222,450 enslaved Africans arrived on Spanish ships between 1581 and 1640
[11] Ibid, p.440
[12] Ibid, p. 440
[13] Ibid, p. 443
[14] William A. Pettigrew, *Freedom's debt: the Royal African Company and the politics of the Atlantic slave trade* (Chapel Hill, 2013) pp. 1-3. Pettigrew discusses the politics around these campaigns by independent slave traders to break the monopoly
[15] Nuala Zahedieh, 'The merchants of Port Royal, Jamaica, and Spanish contraband trade, 1655-1689', *WMQ*, 3rd ser., 43 (1986), pp. 570-93, p. 590
[16] There was complex contemporary debate about whether a charted company or free trade could British national interests in the slave trade, involving numerous political Whig and Tory interests and bringing in questions regarding European competitors, the maintenance of African forts and the RAC's historical success in commercial relations in West Africa. See K.G Davies, *The Royal African Company* (1957)' Pettigrew, *Freedom's Debt* and contemporary documents in Kenneth Morgan ed., *The British Atlantic Slave Trade: Volume 2, The Royal African Company* (London, 2003)
[17] Ibid, p. xxv
[18] Zahedieh, 'The Merchants of Port Royal' pp. 590-1. David Eltis estimates c. 20,000 slaves. David Eltis, *Rise of African Slavery in the Americas* (Cambridge, 2000) pp. 209, 212-213

be granted in the future.[19] Merchants in Jamaica also acted as middlemen suppliers of enslaved people to Genoese merchants who had been granted the *asiento* in 1662.[20] The growing awareness by the English of the potential for profits to be made from trading enslaved people to Spanish America as Spanish abilities to trade declined to almost non-existent, coupled with the relative ease of running the trade from Caribbean entrepôts created a context in which knowledge about Spanish American geography, in particular potential trade outposts, trade routes and harbours was increasingly valuable, particularly owing to its almost complete absence in England. Understanding the geography of Spanish America was key to gaining a foothold in these new markets.[21]

In the 1660s formal English knowledge of Spanish America rested on voyages in Thomas Cavendish and Francis Drake's circumnavigations in 1587 and 1578.[22] Richard Hakluyt's *Principal Navigations* included chapters about Francis Drake's voyage and could be purchased from London book sellers, and a limited number of maps were available.[23] It is probable that English mariners sailing to the Caribbean were familiar with the geography of northern Spanish America, in particular the Spanish Caribbean and parts of the Atlantic Brazilian coast.[24] Contraband traders used isolated inlets near the Spanish ports of Cartagena, Santa Marta or Portobelo and accounts by mariners describe sailing the Caribbean sea, with descriptions of Hispaniola, Cuba and other islands.[25] One contemporary described accessing silver trade on the coast between Rio de la Hacha and Chagres near Cartagena.[26] However, the geography of the southern part of the continent was more obscure to English navigators. Although southern Chile and the Rio de la Plata region were believed to offer little potential for settlement, the coast had numerous highly valuable strategic sites for harbours or trade outposts, and the Straits of Magellan offered an Atlantic-Pacific passage. European navigators had been attempting to sail the Straits since the early-16th century, some with more success than others, but by the late-17th century, there had not been an official English voyage to southern Spanish America since William Cavendish's voyage in 1587. Although the Spanish grip on the geographical secrets of their empire was probably not as watertight as projected by Spanish imperial authorities, investment in the 1660s by the English Crown in expanding their understanding of Spanish American geography suggests they felt they were wanting for information.[27]

[19] Zahedieh, 'The Merchants of Port Royal', p. 574
[20] Ibid, p. 589
[21] A further benefit of expanding English understanding of the vast Spanish American coastlines would be to aid exercises of naval warfare in the region, which as Shinsuke Satsuma has demonstrated, was a widely-supported idea and argument in Britain at the time, and one that was believed could bolster English liberty and bring extra wealth to the nation through trade and plunder. Shinsuke Satsuma, *Britain and colonial Maritime War in the early eighteenth century. Silver, seapower and the Atlantic* (Suffolk, 2013), pp. 1-3
[22] By 'formal' I mean printed, standardised and easily reproducible information, rather than tacit knowledge gained through gossip or conversation.
[23] An edition of Hakluyt's relations was published in London in 1625 by W. Stansby for H. Fetherstone.
[24] The first printed map of Americas (1511) showed the Caribbean islands and Spanish Caribbean coast. Jacobu Crumberger, *A map of the Caribbean* (Seville, 1511)
[25] John Taylor's manuscript diary included drawings of Hispaniola, while Edward Barlow described the Caribbean coast of Spanish America and Brazil. *Taylor MS*, National Library of Jamaica, Kingston. *Journal of Edward Barlow, 1659-1702*, JOD/4 National Maritime Museum, Greenwich, UK
[26] Robert Allen, *An essay on the nature and method of carrying on a trade to the South Seas* (1712)
[27] Maria M. Portuondo, *Secret science: Spanish cosmography and the New World* (Chicago, 2009)

The Straits of Magellan were of particular interest to ambitious merchants and political elites. They are a natural passage between the Pacific and Atlantic oceans but are difficult to navigate due to harsh winds and currents, and the narrowness of the strait made up of multiple channels broken up by islands. Mastering the straits could ensure English passage to the Pacific coast of Spanish America, and access to the lucrative ports and markets such as La Paz, as well as the trade to East Indies. Crucially, it meant that ships could avoid the more dangerous Drake Passage at the southern tip of Spanish America, which was 448 miles longer with winds of up to 60 knots, presenting higher costs and risk of costly loss of ships and cargo. Furthermore, if a network of outposts could be established and safely navigated in Patagonia and the Spanish American Atlantic coast, English merchants hoped to develop routes to trade manufactures or enslaved people directly at Spanish American ports for silver, and then buy silks or textiles from the East Indies trade for European sale. It was against this background that Matthew Wren, under the direction of King Charles II, commissioned John Narborough to lead an exploration voyage to the Straits in 1669 to explore the viability of establishing a trade route. Narborough and his crew sailed a 20,000 mile round-trip from London to Valdivia in southern Chile, making and recording observations of geography and navigation conditions, and keeping journals and maps. In June 1671, the ships returned to England with hundreds of written and drawn observations. Some of this manuscript information was published in maps or books in London in the following thirty years, some of which was positively reviewed by the Royal Society.

Most histories of European empires in the Americas overlook Narborough's voyage, largely due to the disciplinary divide between North American and South American history and limited attention to the Pacific.[28] Three accounts of the voyage by Glyndwr Williams, Peter T. Bradley and O.H.K Spate dominate the historiography, but they do not place the voyage in the context of the colonial economy. [29] They argue that the outcomes were limited in comparison with discoveries made by Francis Drake and Cavendish. According to Williams, 'Narborough's ill-conceived venture had failed miserable. It was a casual attempt to combine a trading enterprise with a reconnaissance mission, and its motives were so transparent that Narborough was fortunate to withdraw his head from the Spanish noose with the loss of only four men'.[30] However Williams's foregrounding of Spanish settlers' discovery of the illegally-present *Sweepstakes* at Valdivia overlooks that collection of useful information did actually take place. Although Bradley focusses on the presence of a

[28] Bernard Bailyn, *Atlantic history: concept and contours* (Cambridge, 2005); T. Benjamin, *The Atlantic world: Europeans, Africans, Indians and their shared world, 1400-1900* (Cambridge, 2009); Elizabeth Mancke and Carole Shammas eds., *The creation of the British Atlantic World, 1500-1800* (Baltimore, 2005); John Parker, ed., *Merchants and scholars: essays in the history of exploration and trade* (Minneapolis, 1965); Steven Sarson, Jack P. Greene, *The American colonies and the British Empire, 1607-1783* (2010); G.V Scammell, *The first imperial age: European overseas expansion, c.1400-1715* (1989)

[29] Peter T. Bradley, *British maritime enterprise in the New World: from the late fifteenth to the mid-eighteenth century* (Lewiston, 1999) and *The lure of Peru: maritime intrusion into the South Sea, 1598-1701* (1989); O.H.K Spate, *Monopolists and freebooters (the Pacific since Magellan)* (1983); Glyndwr Williams, *The great South Sea: English voyages and encounters, 1570-1750* (New Haven, Conn., 1997), '"The inexhaustible fountain of gold': English projects and ventures in the South Seas, 1670-1750', in eds., John E. Flint and Glyndwr Williams, *Perspectives of empire* (London, 1973); Some literature scholars discuss the printed accounts of the voyage in the context of discovery narratives and empire. See Jacob Pollock, 'The voyage Account, the Royal Society and textual production', *Studies in Travel Writing* 17:3 (2013), pp. 281-299

[30] Williams, '"The inexhaustible fountain' p. 29

mysterious Spanish mariner on the voyage, he does assess the charting of the Straits which he regards as successful.[31] Williams and Bradley also overlook other contributions to geographical knowledge in the detailed drawings and descriptions of the strategic harbours at San Julián, Port Dessire and Valdivia, which were extremely valuable because without information that could establish outposts on a trade route to and from the Pacific coast, knowledge of the Straits was useless. A smattering of articles and chapters by other historians similarly do not explore the question of geographical knowledge in the voyages.[32] Williams's characterisation of the voyage as 'casual' also obscures the volume of labour and skill behind the execution of the voyage and information collection, indicating that the human capital involved in the voyage is not understood fully. By looking closely at the observations recorded on the voyage, this chapter argues that the collection of geographical and navigation information was significant and required intense application of labour and skill. Historians also underemphasise the role of Narborough's voyage in establishing the potential utility and value of the southern American region for trade. Information collected by Narborough informed printed geographies of the region and sparked broader interest in exploring the area. Following the completion of Narborough's voyage in 1671, commentators in England accelerated their talk of exploiting the Patagonian, Chilean and Pacific region for English gains. The publication of texts and maps showcasing Narborough's findings were also testimony to public interest in the region.

The chapter re-iterates the straightforward point that trans-Atlantic colonial trade ambitions created demand for geographical information and skills. Narborough's voyage was motivated by ambitions to expand trade with Spanish America and access markets for textile and manufactures in the East Indies via the Pacific, and it required use of navigation, scientific observation and print skills in London to produce the desired information. The first main argument is a re-assessment of the contributions of the voyage to natural knowledge and of the Pacific. It argues that the information collected at ports Dessire, San Julián, Valdivia and in the straits was more significant in volume and in contribution to English knowledge of the region than previously acknowledged by historians. The publication of these observations in London in books and maps made the information accessible to a wider audience, while positive reviews of these texts by the Royal Society are testimony to the quality and legacy of the information. Furthermore, the chapter argues that detail in the information suggests that it was primarily intended to be used by future navigators to the region, as well as prove the viability of trade to decision-makers. The returned maps and journals were not just show pieces. The inclusion of granular detail regarding the appearance of landscape, position of rocks and location of trees and other natural features indicates that mariners recorded information designed to guide navigators through the ports and straits. Overall, the voyages demonstrated viability of sailing to the South Pacific and opened up sixty years of trade attempts by English merchants and others to open the region to larger English trade. The second

[31] Bradley, *The lure of Peru*
[32] Paul W. Mapp, *The elusive West and the contest for empire, 1713-1763* (Chapel Hill, 2011)

key argument relates to skills used in collecting information. The scope of observations recorded required significant application of skill and labour in precision observation, repeated experimentation, attempted accuracy, as well as skills to draw visual geographical records. Precision refers to attempts to use numerical description of natural conditions, and accuracy is the attempt to produce information that was correct in reflecting observed conditions. Observations became less tentative or vague, replaced by numerical estimates of water depths, latitude, distance. Whilst some subjective description was retained, such as describing a harbour approach by the colour or shape of hills, the overall movement was towards increasingly specific and focussed observations, and attempts at accuracy by use of instruments and repeat observation. Some of the skills were quotidian ones held by mariners, illustrating that the exercise of extending empire partly depended on ordinary but long-established skills. However two factors demanded unusual application of these skills: (i) the need to collect information for systematic recording of the region rather than exclusively for navigation, and (ii) the unknown and challenging natural environment. These two factors indicate that mariners were applying a quotidian skill set to different problems and on a different scale to normal practice.

The chapter uses analysis of journals kept by crew members John Narborough, John Woods, Captain Digby and Nathaniel Pockett.[33] The volume of recorded information was impressive. Wood's journal alone contained 383 entries. These accounts, in particular Narborough's journal recently made fully available following a purchase by the British Library, have not been thoroughly analysed by historians.[34] The majority of observations outside places of strategic interest were quotidian remarks on voyage progress and navigation, like those kept in a common log book. However they were also distinctive in the additional information recorded to meet the requests of the Crown. Information was recorded in textual, visual or numeric detail. Narborough and Wood made drawings to enhance written descriptions, including nine drawings of islands Sancto Porto, Madera, Disards, Palma, Faro, Sal, and Bonnevest and three closely detailed drawings of Port Dessier, Port St Julián and the Harbour at Valdivia, and a larger map of the Straits.[35] These large manuscript maps are also held in the British Library collections, where they have received surprisingly little attention from historians. It is not clear whether Narborough himself drew the maps or whether an artist in London produced them using Narborough's sketches, but in either case they rested on Narborough's drawing skills. On occasion, Narborough and Wood obtained information from indigenous people or Spanish residents; however the amount of information gathered was small and will not be a focus of this chapter.[36] 'South Seas' was the contemporary term used to refer to the loosely-defined geographical and political space in the southern Atlantic

[33] These manuscript journals are now in the British Library. 'Journal of J. Wood of a voyage from England to Patagonia' Sloane MS 3833; Journal of Captain Digby Add MS 17848; John Narborough journal and instructions Add MS 88980 A; 'Journal of the voyage of the Sweepstakes to Magellan's Straits' by Nathaniel Pockett, Sloane MS 819

[34] It ended on October 21 1670

[35] There are two known copies of the map, both in British Library collections. K. Top 124.84 which was presented to Charles II, and another version Add. MS 5414.29, which speculated that was made by Hack.

[36] For more see Caroline A. Williams 'Opening new frontiers in colonial Spanish American history: new perspectives on indigenous-Spanish interactions on the margins of empire' *History Compass* 6:4 (2008), pp. 1121-1139

and Pacific oceans around the southern American continent, whereas 'Spanish America' refers to the landmass of the American continent controlled by Spain (all territory to the west of the 370 median line, as defined in the Treaty of Tordesillas).

Contributions to South Seas Geography

European mariners had collected information about the South Seas since the late-16th century. Ferdinand Magellan was the first European to sail the Straits, during his circumnavigation in 1519-22, followed by English mariner Francis Drake in 1577-79. Spanish, Portuguese, English and Dutch voyagers followed suit in the next two centuries. Most of these voyages ran into difficulties that established the reputation of the Straits as arduous and dangerous, and as a result, from 1615 onwards many expeditions chose the southerly route via Cape Horn.[37]

It is impossible to assess the exact geographical knowledge held by an individual mariner or merchant about the South Seas, but the available printed information in England in 1669 suggest that a literate person with 1-3s could buy a map or text that gave a general picture with patchwork details of the continent.[38] One navigation manual (1601) did not give precise compass directions or distances when describing the route to the East Indies:

> the second way [is] through the Straights of Magellane, and so into the South Sea […] the course [from England] is for the *most part* southwest and to the westwards *about* 2400 leagues, and the latitude of the straights is 52 degrees and a halfe towards the Antarctike Pole, and on the starboard side is the firme land of America.'[39] (emphasis added)

This uncertainty continued as the manual advised that in the straits 'the course may be West or West southwest one hundred or 140 leagues before that they be cleerely in the south sea'.[40] Another manual (1657) gave compass variation east (5'0 and latitude (47'40), but omitted latitude of the straits.[41]

Maps and geographical books about Spanish America also had limited detail. John Seller's *Atlas Terrestris* (1665) included separate maps of islands and states Barbados, Carolina and New Jersey, but covered South America in a single continental map.[42] 'Magellenick Land' was labelled with San Julián, Port Drake and 'Baldivia' (Valdivia) written, but not Port Dessire. It was a small map covering a large geographical area coverage, making it difficult to discern precise detail. In *Cosmographie*, an influential 500-page world geography,

[37] Michael A. Morris, *The straits of Magellan* (1989), p. 10
[38] Joseph Moxon's world map in 1672 cost 2s. *Term Catalogues Vol. 1*
[39] William Bourne, *A regiment for the sea* (1601) pp. 70-71
[40] Ibid, pp. 70-71
[41] Edward Wright, *Certaine errors in navigation,* (1657), p. 39
[42] John Seller, *Atlas terrestris* (1665)

South America was drawn with a roughly u-shaped channel to indicate the Magellan Straits, with Valdivia and San Julián labelled. Magellan was described as 400 leagues in breadth 'in some but only 90, and in others less'.[43]

Figure 15: *Americae descriptio nova* (1652)

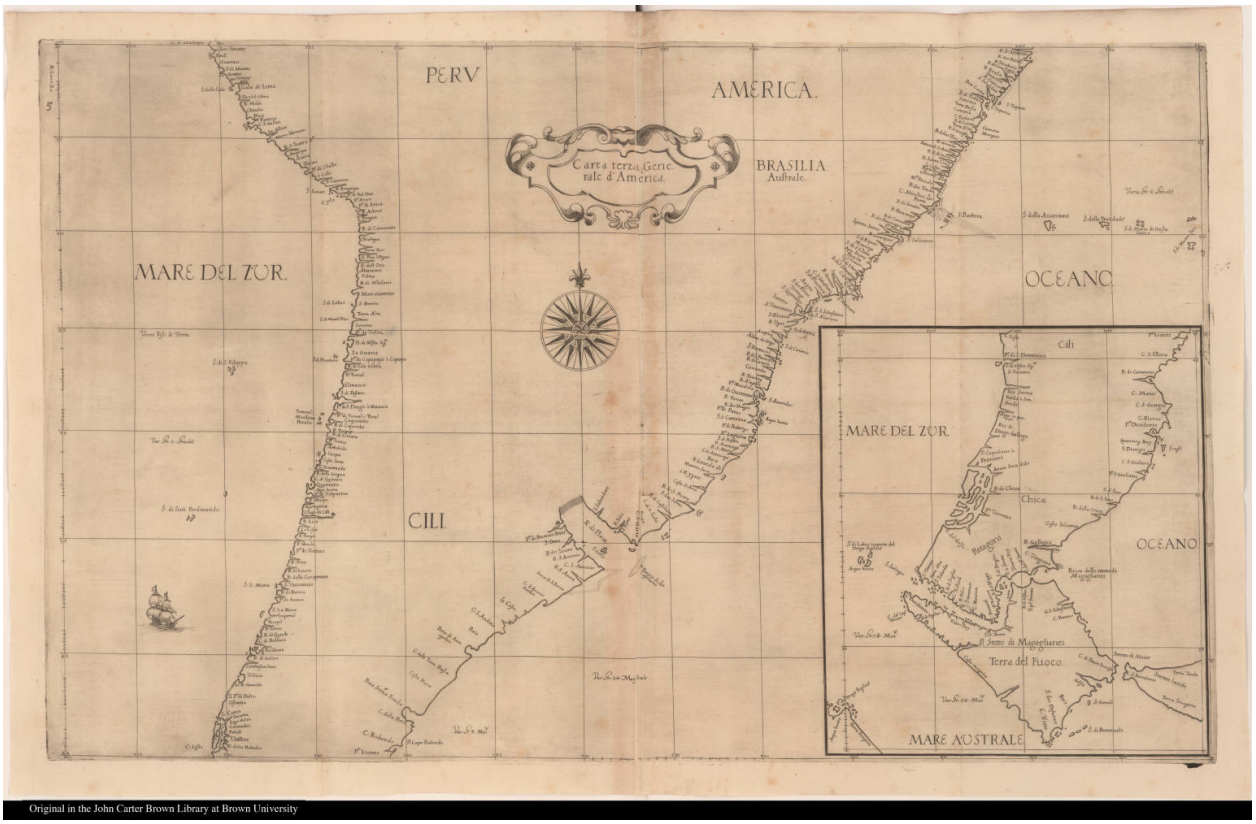
Original in the John Carter Brown Library at Brown University

America Meidionalis (1625) had similarly limited detail, while *Mercator's Atlas* (1635) included a map with a simplified u-shape of Magellan Straits, but just 5 islands dotted through the channel. The last known European printed map of the Straits was published 23 years before Narborough's voyage. It marked Dessire and San Julián, and in the Straits showed some inlets, islands and a varying channel width, contrasting with the uniform width of the straits drawn on earlier maps.[44] However, it still lacked navigation detail such as latitude, rocks and water depths. Naturally Spanish map-makers probably had the best quality information but the focus by the *Casa de la Contratacion* on keeping geographical secrets by controlling publication of manuscript information meant that it is unlikely that Spanish information was accessible by English mariners.[45] The information

[43] Peter Heylyn, *Cosmographie* (1652) p. 159
[44] Robert Dudley, *Carta terza generale d'America* (Firenze, 1646)
[45] Alison Sandman, 'Controlling knowledge: navigation, cartography, and secrecy in the early modern Spanish Atlantic' in Dew and Delbourgo, eds., *Science and empire in the Atlantic world* (New York, 2008). David Buisseret, 'Spanish colonial cartography, 1450-1700' pp. 1143-1171 in *The history of cartography: volume three part 1 Cartography in the European Renaissance* (Chicago, 2007)

available in England was illustrative rather than comprehensive or precise, with absent or contradictory measurements of longitude or latitude, absent information about water depths or tides, and it was probably of little use to navigators. These texts are suggestive of the limited information Narborough could access while preparing the voyage and when at sea, as well as further highlighting the incentive for improving knowledge of the region.

Figure 16: Carta terza generale d'America (1646)



Narborough's instructions ordered him to sail southward of Rio de la Plata to 'make observations with as much accuracy as you can of all headlands, bays or havens, roads and mouths or rivers'.[46] He was told to record information about navigation of the Straits, and about ports Dessire, San Julián in Patagonia, and Valdivia in Chile. The Straits of Magellan are in the southern tip of South America, and are 570km long and at the narrowest point 2km wide. The three ports form stepping stones to and from the Straits. Dessire is located on a peninsula in modern-day Argentina, at the mouth of River Deseado, 699km north of the eastern entrance to the Straits. San Julián is a natural harbour 180km south of Port Dessire. Ferdinand Magellan and Francis Drake had visited both ports and spent the winter at San Julián in 1520 and 1578, and the ports continued to be sites of stop-over in imperial scientific exploration into the 19th century when Charles Darwin visited on the *Beagle* in 1833.

The focus on collecting information about these strategic points highlights English ambition to build a network of coastal outposts to structure a coastal trade route into and through Spanish America. This contradicts suggestions by historians such as Steven Pincus that England intended to build a second territorial empire in South America.[47] Narborough's voyage was supposed to produce trade and navigation information with sufficient local detail to allow future pilots and navigators to negotiate the route from the Brazilian coast to the Pacific Coast of Chile. In further evidence of this 'light-touch' exploration, Narborough was instructed to avoid aggravating the Spanish- 'you are not to medle with the coast of America nor send on shoare unless in case of great necessity […] you are not to doe any injuries to Spaniards as you shall happen to moore nor meddle with any plate'.[48] This approach contrasted with the explicitly territorial Scottish voyage to the Isthmus of Darien voyage thirty years later.

Narborough was asked 'to cause draughts or designs to be made'. Images were crucial to navigation and geographical understanding. In addition to maps and charts, pilots and navigators also used prospect drawings of coastlines and harbours to determine their position and to navigate in coastal regions.[49] These accompanied precision-drawn charts, and ran in sequence so a mariner could compare the images to landscape in front to determine position and course. This is further highlighted in instructions given by Narborough to one captain, Fleming, to collect information about geography and natural features:

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[46] Add MS 88980 A

[47] Steven Pincus argues that in the 1700s leading Tories including the founder of the South Sea Company Robert Harley were interested in territorial conquest and a new empire in Spanish America. However discussions in contemporary pamphlets about beating the French at their own game of an entrepot-based trade network in Spanish America, the limited attention paid to proposals to establish a settlement at Valdivia in Chile, and the focus on the trading aspect of the South Sea Company all suggest that a trade empire not territory was motivating English merchants and political elites. Steven Pincus, 'Rethinking mercantilism: political economy, the British Empire, and the Atlantic world in the seventeenth and eighteenth centuries', *WMQ* 69:1 (2012) pp. 3-34, 25-26

[48] Add MS 88980 A

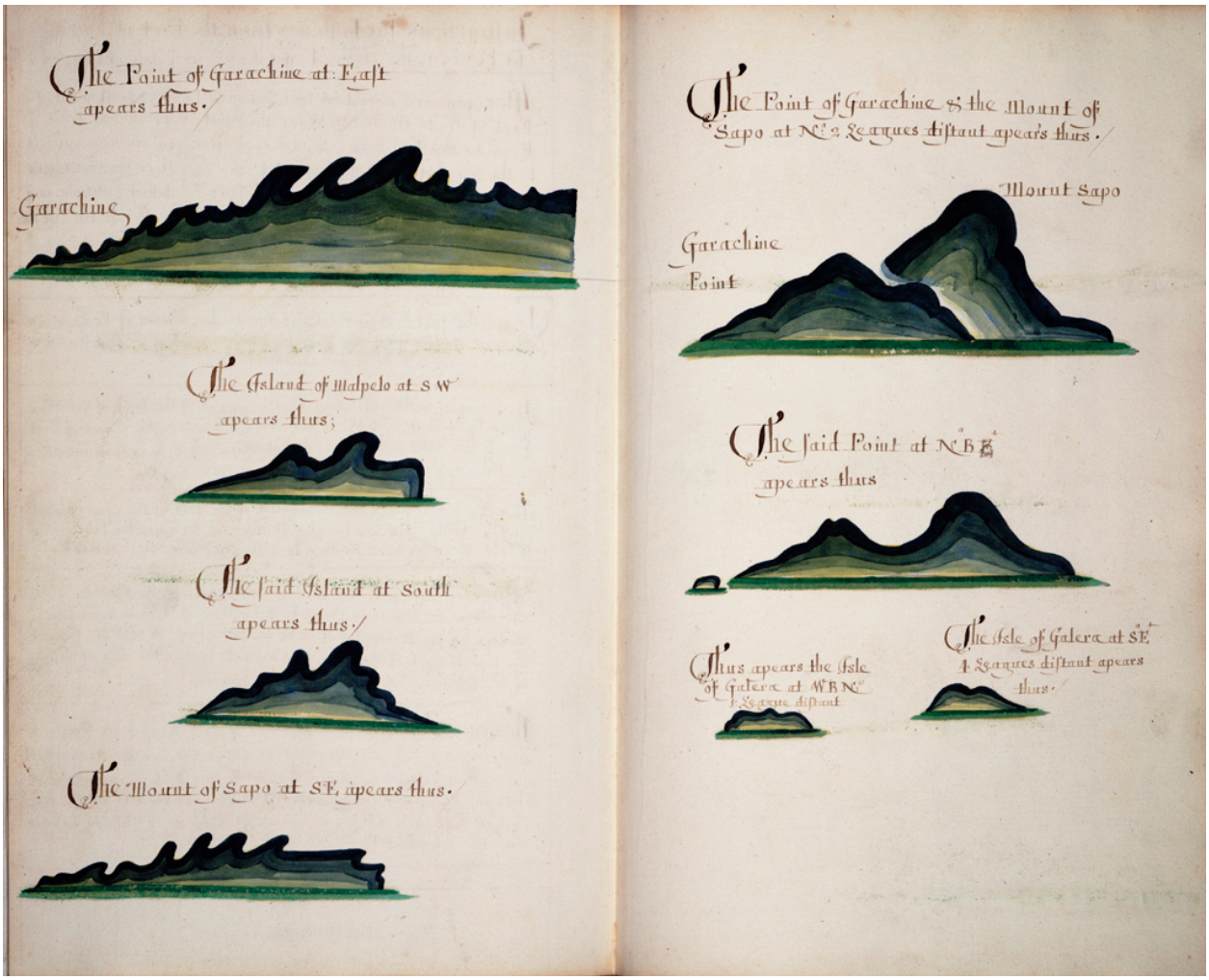
[49] As highlighted earlier, drawings of headlands and coastlines remained an important part of pilot atlases during this period, in addition to the prospect drawings of geographical spaces and charts covering vast geographical areas, with rhumb lines and drawn to scale and projection. John Seller's English Pilot atlases mixed charts drawn to projection, with prospect drawings of geographical features such as bays and harbours on coastlines, used to enable a pilot approaching landmass to identify specific small geographical details to aid navigation along a coastline or into a harbour

> You are to take observations with as much accuracy as you can, and also to cause your mate and company to do the like, to observe all head-lands, islands, bays, havens, roads, mouths of rivers, shoals, soundings, courses of tides, and settings of currents, and cause draughts to be made of them. Also you are to take notice of any trade winds you meet with, and of the weather and especially to observe harbours in the Straits of Magellan.[50]

This amounted to a vast amount of information. The breakdown of the categories - headlands, bays, islands, havens - corresponded with information in prospect navigation drawings, further suggesting that as well as information regarding the geography of over 600 miles of coastline, small-scale information of specific use to navigation by pilots entering harbours was also valued. Narborough's request included the 'mate and company', suggesting that ordinary crew members were believed to be competent in scientific observation. The crew was asked to apply a standard of accuracy, indicating the value placed on ensuring new information was as correct as possible. Narborough required the crew to record soundings, courses of tides and settings of currents, demanding use of instruments such as a log-line and compass as well as precision observation. Harbours in the Straits were highlighted as particularly important, indicating that the Crown wanted information that would enable ships to navigate and anchor in the passage.

[50] The captain of the *Batchelor* was Captain Fleming, and the mate was Greenvile Collins, who later became influential due to his role in producing the first Coasting Pilot of the English coastlines. Coolie Verner, 'Captain Collins' coasting pilot a carto-bibliographical analysis' *Map Collectors' Series No.58,* (1969)

Figure 17: Example of coastal prospect drawings. Garachine in Spanish America, William Hack atlas (1685)[51]
Reproduced with permission of National Maritime Museum, Greenwich, UK



The voyage began like any ordinary cross-Atlantic European voyage. On 16 September 1669, two 300-ton ships, the *Sweepstakes* and the *Batchelor*, left Deptford with 90 men and 14 months of supplies. Two weeks later, the ships arrived at the Madeira Islands off the coast of west Africa. Here Narborough set a course South-South-West, and on 23 October the ships crossed the Tropic of Cancer, where Narborough instructed sailors to let blood in order to 'preserve their health'. On the 30 October, the *Sweepstakes* reached the Cape Verde

[51] P/33(48), National Maritime Museum, UK

islands, and anchored for five days at Port 'Praya' on Island of St Jago. 64 leagues west from the Cape Verde Islands, Wood recorded compass variation of 10:00 east but described contradictions in existing charts,

> all this day we expected to see one of the islands Easter Trinidade or Acention but could see neither. By my reckoning I sayled by a Duch draught printed 10 leagues to the eastward of Acention and by an English draught 30 leagues made by one welch but by one of mercators leagues the Hollands draught maketh the land lye 100 leagues more to the westward then our English one.[52]

Wood made 8 drawings of Atlantic ports and islands. At the Madera islands and Praya harbour he made prospect drawings with marks showing the location of fresh water and landing places - information that could help ships land and restock supplies. The designs were simple, showing the outline of headland and coastlines - the drawing of Sancto Porto showed outlines of three hilly areas, with gaps in between them. They each filled one journal page and showed the view of a harbour or island to a navigator from specified angles, such as 'from the position 'SSW from you 8 leagues' for Madera Islands and for Sancto Porto 'drawn when is SE by S from you 8 leagues'. This made them literal representations of the geographical landscape designed to be used by a pilot. This precision of measurements and emphasis on utility contrasted the drawings with the earlier descriptions and maps produced of the space.

By 8 January 1670, Narborough had expected to reach *Ascension* island in the south Atlantic ocean, but he recorded that he not sighted it, further highlighting inconsistencies in existing information. On 24t January Narborough wrote, 'I judge a current sets out of the River of Plate, for I find nine miles more to the southward than I expected, I have been careful by my course and variation, which is but 18 degrees 20 minutes east, by an amplitude taken to night'.[53] They set a course for Port Dessire, but locating the port was also difficult, and on 22 February Wood saw Penguin Islands and presumed they had sailed past Port Dessire. The ships finally found the harbour on 27 February, where the crew recorded a series of new observations. Nathaniel Pockett and Wood recorded latitude 47:90 South, different to the 47:40 recorded in Edward Wright's manual (1657).[54] Wood wrote directions for negotiating the tide when entering the port: 'a ship may go into Port Dessire at any time of the tyde if the wind be fair for there is water enough and low water, and at 3 fathoms ebb you may see all the dangers going in'. He continued, 'I would not advise any man to go in with this ship til he has viewed the harbour at a low water for then he will see the danger very plaine'. He also used descriptions of the rocks and islands to give directions for finding the harbour if sailing from the North,

> A pecked Rocke n the south side of the harbour, high water at two o clock in the bay at full charge the tide riese two fathoms sixe fathoms in the harbour mouth at a low water. Withe the Point lyes two small rocks to be seen at half ebb.[55]

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[52] Sloane MS 3833
[53] *An Account of several late voyages and discoveries to the south and north towards the streights of magellen […] By Sir John Narborough* (1694)
[54] Sloane MS 819; Wright, *Certaine Errors*
[55] Add MS 17848

This information enabled a navigator to identify the south side by a protruding rock. Wood also measured water depth to be '25 fathom water 2 leagues from shoare', offering a textual map of the harbour around shallow water and rocks, aiding understanding of safe places to anchor and how to enter the harbour. Narborough also recorded the location of two springs of fresh water for ships to find supplies, communicating that there was potential for ships to dock for longer than a short stop-over. The need for quality information about the difficult port is highlighted by John Strong's 1689 voyage when strong winds prevented the ship from refreshing at Port Dessire.[56]

Narborough and Wood went ashore to record information, further highlighting the scientific demands made on the crew. Wood found Port Dessire 'to be a fine beath all along the shore but the country is all barren without other wood or water'. On 23 March, Narborough travelled up river from Port Dessire and spent one day recording the geography. Like Wood, he recorded new information that would be useful for traders. He estimated that the river extended 22 miles, and that it travelled West-South-West. However he was not impressed by its potential utility,

> Their is several small islands but all good for little the hills are very rockey up the river, it ends in a salt lake - at the head noe bushes or wood or fresh water to be some up a lost nor minerall nor anything that is good. The land is dry and barren hilly. I drew a draft of the river.[57]

Narborough's draft was included in his manuscript map 'A Draught of Port Dissier Harbower: Latitude 47=4'S' which was 565 x 438mm and described the harbour approach as well as the area from the harbour to the river source.[58] Although decorative detail was included -- ostriches, a fox, hare, duck and a goose, alongside three people called 'natives of the land' – navigational information dominated the chart. Seven small islands were drawn inside the harbour, and drawings of the ships marked the route taken by the *Sweepstakes,* to indicate navigable channels. The chart had 286 depth marks, with almost two-thirds in the sea on the approach to the harbour entrance, and with 78 inside the harbour and 65 along the coastline. Inside the harbour the depth ranged from 40 to 1, indicating that there were some no-go zones for ships. It marked seven anchor points, five in the sea outside the harbour and one inside the harbour area. Penguin Island was drawn to the south of Port Dessire, which Narborough also described in his journal. The island measured half a league according to the scale, with 27 rock marks around the coastline. Penguins were drawn on the island, and two rowing boats to indicate that the *Sweepstakes* crew had visited, visually asserting the presence of the *Sweepstakes* in the Port Dessire area. Wood also sketched a one-page drawing of the harbour, which was significantly larger than his previous sketches with 22 depth markings, and at least 30 rocks. Inside the river mouth and harbour Wood

[56] Bradley, *British Maritime Enterprise,* p. 446
[57] Add MS 88980 A
[58] Add MS 88980 C Manuscript chart of Port Dessire

drew 12 points of interest, including five islands (Le Maire, Hare, Shag, Seale, and Penguin), a mark for fresh water, a beach, and two large rocks, all marked with a key.

These details made the drawings the most comprehensive maps of Port Dessire made by English to-date and demonstrated that the port was navigable. The journals and maps represented a significant survey of the harbour, with over 300 measurements and information that potentially could guide a ship through the harbour approach and into a safe anchoring. The focus on the harbour interior rather than the broader coastal geography indicates the interest in producing granular detail to aid maritime or mercantile use of the harbour. Wood and Narborough also invested in surveying the geography of up to around 6 miles inland of the harbour, including the course of the river, highlighting their collection of information linking harbour trade to inland trade as well as the potential to build the structure of an outpost. This information was much more limited than the coastal and harbour information however, probably due to the maritime expertise of the crew rather than topographical.

One month later the *Sweepstakes* left Port Dessire, and sailed south. At Port Diones, Digby described a series of rocks: 'To the Sea board of the island there is a ledge of rocks lyes off 5 miles. Four leagues from the island lyes a rock like the 9 distance east from the island just appearing along the waters edge the *Sweepstakes* passed before the ledge and the distance'. The navigators used descriptions of the landscape made by Francis Drake and Nunez de Silva to judge their distance from San Julián. On April 3, they explored a harbour but decided that it was not San Julián because 'Mr Flecher who was Sr Francis Drakes Chaplin sayeth that on the south side of the harbour was pecked rocks like towers and hear is none'. Their latitude was also inconsistent with the latitude reported by Francis Drake and so the *Sweepstakes* sailed further south. Previously published information was clearly used as to navigate, even when it was inaccurate, demonstrating how older information and new observations worked in tandem to produce new knowledge.

On 7 April 1670, the *Sweepstakes* entered Port San Julián, 112 miles south of Port Dessire. Digby visually described the local landscape to give explicit directions in entering the harbour,

> the white spots in the hill noted with the same marke when those are one in another, you may run in & for that markes to know when you are on the bar there is to the northward of the harbors mouth sertane whiteish clifes which seem to be an island when the midle of these clifes & a valley or sadle in the land behind them are one in the other, then you are on the bar.

Narborough recorded the harbour as 49 degrees and ten minutes, and longitude as 63 degrees and ten minutes, however Pockett recorded latitude as 49:00 South, indicating that variations could occur even from the same ship. Digby also recorded longitude as 'neare 75-degrees or five hours diference of time', adding further detail. Digby recorded, 'as for the lattitude of the harbour I found […] to be exactly 49-14'. Published account to date had not included latitude of the port. Wood also recorded observations that could help navigators enter the port. He cautioned that easterly winds could alter the harbour sand bar, but that the best mooring was between the island of True Justice and the beach island in 3 fathom water at low tide. He also remarked that harbour

tides were 'very irregular and unconstant'. He described dangers in hidden rocks, writing 'there is long ledge of rocks which run from the point and ebb. These I call Mussell Banck, you may burrow in 4 or 5 fathom […] but take care you doe not hooke yourself within these leges of rock.' On April 8 Narborough explored up-river, and recorded that the head of the river was six miles from the mouth, and that a pond of fresh water was located one mile was located from the river. Narborough also caught 500 fish - valuable information for ships in need of provisions and for traders seeking to sustain an outpost.

Narborough produced a chart of San Julián harbour. It was 580 x 448mm, to scale 3.8cm:1 mile, and showed the open sea by the bay and the channel inside the harbour. The length of the bay was 8.4 miles.[59] The width of the harbour was 5.2 miles at its broadest, and 0.6 miles at the entrance, and the length of the coastline covered was 15.2 miles. These measurements indicate that the size of the area surveyed and information collected was substantial. It contained more detail than Narborough's journal, including 377 depth marks, requiring at least 377 measurements. A note explained that 'the figures signified the fathoms of water', highlighting the desired utility of the chart. This is supported by Narborough's inclusion of anchor marks inside and outside the harbour, indicating possible routes and rest places. The chart also included shoals, some extending as far out to sea as two miles and 3.9 miles across. The depth of information asserted to viewers the thoroughness of Narborough's survey by suggesting that the *Sweepstakes* had moved around the harbour and sea and anchored in at least eight places to take measurements. Notes described the location of the harbour and additional navigation information, and explained that San Julián was in 49:00S latitude and longitude of 63W from the Lizard, with 16:30 easterly compass variation. Another note explained that the 'tide rise nere fewer fathoms one the springs & run stronge, it is a high water at half an hour past eleven of the clock, on the change day of the moon is a bard harbour'. Information about water depths and the structure of the harbour was expressed in both precise measurements and subjective descriptions of the appearance of hills and 'whiteish' cliffs. Like at Port Dessire, these observations added up to an impressive new geography. It located the port precisely on the Atlantic coast, theoretically enabling navigators to set a direct course from other locations, and gave information to mapmakers to depict it on future geographies. In contrast to most maritime voyages, the mariners spent five and half months at San Julián (due to the need to wait out wintery conditions) which enabled them to collect the high volume of information producing a far more detailed image of the area than previously available.

On 16 September 1670, the *Sweepstake*s emerged after wintering at San Julián to wind that 'blow fresh'. As the ships sailed south towards the mouth of the Straits, Digby described 'good rideing' and a low beach stretching southwest for four miles. Digby continued that when passing a bay at the mouth of River Gallegos, 'one must keepe some distance from the shoare for there lyes shoales 4 leagues off from River of Gallegos.

[59] According to my measurements using a ruler and the map scale

The shoale is in the lat of 51:38 and the Bay runs to the lat of 51 and 46.' They rested at Penguin Island for two weeks, where they saw hundreds of seals and penguins, probably the first mariners had ever seen. On 23 October at 4.30am, the ship 'ran in for the straits' which Narborough described as a ' very remarkable land'.

Narborough and his crew spent 28 days in the straits and filled in some of the geographical gaps in the earlier broad-brush pictures. Rather than a single strait, they are 311 miles of islands, channels and bays that curve in a v-shape southwards from the eastern entrance in Patagonia to Cape Froward for 160 miles, and then in a north-western direction to open into the Pacific Ocean on the coast of Chile.[60] The width of the strait varies from 22 miles to 1.5 miles, with average width of 4 miles. By comparison, the English channel, which English mariners would have been more accustomed to navigating, is 350 miles long and 20.6 miles at its narrowest in the Strait of Dover. Weather conditions in the straits are severe and vary, and strong tidal currents are present throughout. At Point Possession at the entrance, Narborough wrote, 'I sailed, rounding the shore being unacquainted, and could not tell certainly where the Narrow lay, for it was shut in one Land with the other, so as I could not see the opening'. Wood highlighted the difficulties of entering the straits, writing that they were forced to sail back two leagues to anchor near the middle of the channel. Two days later they passed the first and second narrows, anchoring at night at Queen Elizabeth Island, highlighting safe anchorage places in the eastern straits. They also described hazards of low visibility and difficult weather conditions. Narborough certainly had navigated in difficult weather and tricky waters before, however when combined with the almost zero knowledge about navigating the straits, these two days of attempted entry must have presented challenges to Narborough's abilities. These dangers of sailing have been overlooked by historians judging the achievements of Narborough's voyage. Testimonies from later voyages to the region testify to the area's isolation and dangers faced by mariners or settlers - in 1695 one mariner wrote: 'in a little island situated in the middle of this river, we met with a dead body half rotten and covere'd with a foot of earth, though we could not distinguish whether it was the corpse of a European or a Savage'.[61]

A key contribution was an estimate of the length of the straits from the Atlantic ocean to the Pacific coast. Narborough recorded that they were 116 leagues in length, including 'every reach and turn' - a drastic reduction compared to the estimates of 400 leagues in Heylyn's *Cosmographie* and increase on 34 leagues (120 miles) in an edition of *Mercator's atlas* published in 1635.[62] Today the straits are considered to be 350 miles long, or around 100 leagues, close to Narborough's estimate. This suggests that the information collected by Narborough was close to capturing the actual length that future navigators had to negotiate, suggesting the information would be of use. Of similar importance were calculations of longitude and latitude, which allowed for a more precise mapping of the location of the Straits. Some of these were new measurements. Narborough recorded that Cape Deseado lay at latitude 23 degrees and five minutes south, and in longitude west from the

[60] Google maps search 'Straits of Magellan'; Morris, *The straits,* p. 18
[61] *Voyage of coasts of Africa, Streights of Magellan, Brazil, Guyana and Antilles/Cariby Islands,* National Maritime Museum AND/47
[62] Peter Heylin, *Cosmographie in four books* (1652); T. Cotes *Historia mundi: or Mercator's Atlas* (1635)

Lizard, 72 degrees 76 minutes, with meridian distance of 1149 leagues. Navigation manuals that included latitude for the Straits did not include Cape Deseado, therefore by recording this latitude, Narborough, Digby and Wood added new useful information. They corrected existing recordings of longitude and latitude. William Bourne had written that the Straits were at 52 ½ latitude. At Cape Blanco, John Wood wrote that the longitude from the Lizard was 61-48, 'which was 8 min more than Mercator maketh it which is a very insencouable error we beinge one hundred and nine dayes from sight of any land'.

In the middle of the straits Digby described a cape where ships could anchor safely: 'Cape Gallant is 13 or 14 leagues from Cape Froward on the N side… [it is] a small harbour where a ship may recourse her self without anchor or cable 16 foot water at a low water and no tide'. He also suggested there would difficultly passing through a central channel - 'two great islands in the middle of the channel full of timber here, one would thinke there were not passage and it runs to the NW'. On 15 November Narborough described Cape Deseado which signals the end of the straits at the northern and western-most point, and comes at the end of a series of broken-up pieces of land with small inlets, bays and channels running between them. To enter the open seas into the Pacific, Narborough advised 'Cape Diseado bear S West South from mee by my compass distance three leagues. I saw all the South Sea oppen but finding I could not get into the South Sea, I bar into the Streights and anchored in a bay on the south shore.'

In addition to describing geography, the crew also measured water conditions and tides. Whilst this information would not prove viability of trade in the Straits overall, it made the negotiation of the channel easier. They measured water depth at Cape Virgin - according to Digby 'there lyes shoales about a league off, give them a league birth and there is no other danger', explaining to mariners that after negotiating the shoales, the mouth of the straits would open in front. He warned ships to avoid sailing within a league of shore otherwise they could beach on banks in the shallow water. Narborough wrote about the strength of currents and tides in the eastern opening of the straits:

> we thought to have sayled through the first narrow this day but the tyde of comeing through so strong we could not stem it so we sayled 2 leagues back and came to ancker in 35 fadom beachy ground very neare the middle of the chanel.

Narborough described a 'deep bay more than ten leagues all along the shoare 30 and 36 fadoms' and that a strong tide forced the ship back. Recording changes in tides and currents was particularly important as the straits were notorious for fast-changing and unpredictable tides. The narrowness of the straits left little leeway for a ship to quickly change position in order to avoid an emptying section or fast-moving current that might force the ship into a dangerous position. This information provided both a warning and solution to navigators - at times the tide in the first narrow of the straits was too strong for a ship to overcome but that it was possible to safely wait two leagues away in deeper water. This detail was not in printed accounts of the area.

Rocks were also important to look out for when navigating. Narborough warned in a lucid description that immediately before entering the Pacific, navigators would find a series of dangerous rocks at Cape Pillar and Cape Deseado. He named the rocks and identified their latitude,

> there lie many shatter'd rocks which are above water, and shew like the Ruins of Old Houses: and there are ledges of rocks that are sunk, which lie near four leagues off of the Cape, West; the sea breaks much on them, and they are dangerous: they lie in the latitude of 53.d 10m South, by my reckoning: I called these rocks The Judges, they are near ten leagues distant south and by West from the Isles of Direction.

Like at the ports, Narborough made sketches that became a 0.8m by 1.8m manuscript drawing of the straits with a significant amount of useful information. The entrance was labelled 'Sweepstakes Bay', and showed the ship's route, with detailed drawings of the landscape and labels of physical features and landmarks. Locations of rocks, water depths, shoals and sand banks, inlets, longitude and latitude markings were drawn, as well as good or bad places to anchor ship. Text explained dangerous areas and places to find provisions, such as 'dry at low water', fresh water runns downe in most places', 'good rideing and good fishing' and 'sounds run into the sand'. The movements of the tide into and out of the straits received special attention. One note read, 'the tide of flood comes from the southwards and sets strong into the straits at the first narrow' continuing, 'it is much better to come from the westward, then to go to the westward for the winds as much turn to blow westerly and that is the course though navigation is difficult'. Unlike printed sailing charts of the period it was not drawn to projection, and it did not have rhumb lines (criss-crossed lines drawn onto charts used for plotting courses).

The functions of the manuscript maps were varied. They were almost certainly presented to the King to report back on the voyage achievements, and were also used as the basis for printed maps.[63] Narborough's drawing was used in a map of the straits published by John Thornton in 1673.[64] It combined navigational information such as water depths and anchorage marks, with topography like hills, peaks and trees on the shores of the straits. The navigational detail matched Narborough's map, including the anchorage points, rocks, and depths markings and the outline of the coast. However it did not copy the manuscript entirely. Details were added to standardise the drawing into a chart, including the inclusion of a scale (to 60 English miles), longitude marks on the borders, as well as rhumb lines. A key in the corner of the map located 15 islands within the straits. Thornton also included a large inset of the Southern American region, showing Patagonia and Terra del Fuego, to indicate the location of the straits relative to the Americas. As with the manuscript material, the map combined information about wildlife, topology and ethnology (a drawing showed 'the forme of the Indian house) with precise navigational information and textual notes about provisions and safe passage. The scope

[63] Basil Ringrose, Derek Howse, *A buccaneer's atlas: Basil Ringrose's South Sea waggoner : a sea atlas and sailing directions of the Pacific coast of the Americas, 1682* (California, 1992) p. 262

[64] John Thornton, *A new mapp of Magellan Straits discovered by Capt. John Narborough [Commander then of his Majesties Ship the Sweepstakes] as he sayled through the sade Straights* (1673). Historians disagree on the original date of publication of this map. I have used Sarah Tyacke's estimated date of 1673

of the information now available to buy in London greatly exceeded what had been available before 1669. John Thornton was a successful publisher and map maker, and this map was later included in the Blathwayt Atlas, suggesting that it was considered to contain valuable and useful information, and that the quality of the Narborough's information was respected.[65] Thornton was also clearly willing to capitalise on the status of the voyage, naming the map after 'Capt. John Narborough, Commander of his Majesties Ship the Sweepstakes' who 'discovered' the straits. Glyndwr Williams argues that the map 'remained the standard authority for years to come', indicating the reach of the information that Narborough collected.[66]

Narborough's information was also referenced in a propagandistic map printed in 1711 asserting territory where the South Sea Company could trade.[67] 'S. J Narborough tract through the Straits of Magellan' was written along a route drawn from the Cape Verde Islands to Magellan, suggesting that the maker consulted Narborough's account and that there was sufficient social currency in explicitly referencing his voyage for publishers to devote space to it.[68] The note was also an opportunity to further assert English rights to trade by demonstrating prior English success of navigating the region. However Narborough's information did appear to have a shelf-life, as indicated in a map of South America published in the early-18th century that focussed instead on the voyages by buccaneer William Dampier (as discussed in the next chapter).[69]

The ships spent 28 days in the straits before emerging into the Pacific Ocean at Desolation Island on 19 November. They sailed north almost 1,500km to reach the port of Valdivia in Peru. This region on the western tip of the Straits was barely populated due to inhospitable conditions and probably because the Spanish monopoly in the region had never been sufficiently challenged to warrant investment in a defensive settlement at Cape Deseado or Cabo Pilar. In reality the Spanish American empire only stretched as far south as Valdivia and the city had been previously abandoned following indigenous uprisings and natural disaster in the late-16th century.[70] Valdivia was therefore relatively unprotected but had great potential for development en route to the more lucrative ports of Lima and Acapulco - making it a desirable place for English traders to better understand. Narborough was specifically instructed to 'sail along northwardly til you come so high as Valdivia which lie about forty degrees of southern latitude'. Narborough later corrected the error in his instructions, when he observed that the harbour mouth was in the latitude 39d. 56 minutes south. He also measured longitude from

[65] Thornton was Hydrographer to the East India Company and the Hudson Bay Company
[66] Williams, "The inexhaustible fountain' p. 30
[67] The map was produced to assert the reach of the South Sea Company in Spanish American at time when the Company was trying to drum up public support. For discussion of propaganda texts about the company, see Arne Bialuschewski, '*A true account of the design, and advantages of the South-Sea Trade:* profits, propaganda, and the Peace Preliminaries of 1711' *Huntington Library Quarterly,* 73:2 (2010), pp. 273-285
[68] Herman Moll, *A new and exact map of the coast, counties and islands within ye limits of the South Sea Company* (1711)
[69] Herman Moll, *To the right honorable Charles of Sutherland, this map of South America* (1709)
[70] From 1645 onwards the city was repopulated and rebuild under the control of the Viceroyalty of Peru and a series of fortifications were built in the river, becoming one of the largest fortification systems in the Americas, largely due to the strategic position of the port in defending the South Pacific coast

the Lizard as 70d.19m. On 15 December, Narborough entered the bay of Valdivia and described it as a large and deep bay with 'good riding' in the south-east. Narborough was impressed by Valdivia. He described it as,

> a very fair porte and good outpost […]Another river runs about a pointe to the NEward of a good breadth which runs up to the of Baldivia. In the Crack between the two rivers is a fine small island, adjacent to the East mains in this island is a small castle or fortifications or guns […] Thoe woods are green the land is rockey tho timber is but ordinary.

Narborough's 570 x 440 mm chart of Valdivia showed the harbour with two rivers leading from the open sea and bay up to the city.[71] It included 62 depth marks, ranging from 71 to 4. Although this was far fewer than for either San Julián or Dessire, it remained a large number for a harbour where they were actively monitored as enemy ships by Spanish residents. The body of water where depth marks were noted was large at 42 miles squared.[72] Narborough included notes about the local conditions such as 'good fresh water', 'good fire wood', 'apple trees' and 'good fish'.

Although visual information was limited, it included more textual description than other charts. One note explained, 'The current sets generally out of the three steams tho water is fresh at tho six fatham, and it is but brackes at the very mouth […] Black sand all the by over the outermost Shipp signifies tho sweepstakes at anchor.' It continued, 'the highe spring tide rise eight foot and it is high water at nine of the clock on the change day the variation of the compass is eight degree easterly hour I observed by longitude'. Unlike other maps, Narborough did not draw an English flag, which suggests that although technically the other ports and the straits were under Spanish control, he believed they had greater potential of being used or partially settled by English mariners than Valdivia. The time spent at San Julián and Dessire by Narborough and his crew was limited only by supplies and the seasons, giving them up to six months to survey the area, and therefore the navigational detail of the Valdivia chart was significantly sparser; however, it was the most significant in display of useful political and economic knowledge due to the prime strategic position of the port.

On 22 December 1670 Narborough's crew began the long journey to return to London, re-tracing their outward route. Narborough continued to record details and returned to Port Dessire and Port San Julián, however the details were sparser and the ships spent less time exploring the areas. On 10 June 1671, Narborough wrote that he sighted the Isles of Scilly. They had spent 609 days at sea.

The journals of Narborough, Wood and Digby were published in the 1690s. In 1694 an edited collection of voyages published by Sam Smith and Benjamin Walford (Smith and Walford were also printers for the Royal Society) included Narborough and Wood's accounts.[73] It was in the style of discovery epics common to the period, and included entertaining snippets such as at Valdivia where 'Don Carlos was put a-

[71]Add MS 88980 D Manuscript chart of Valdivia
[72] Calculated using ruler and the map scale
[73]*An Account[…] By Sir John Narborough* (1694)

shore, and carried with him a sword, and a case of pistols, and his best apparel'. Despite this popularised content, the book contained a lot of ordinary navigation information. It included almost as many entries as Narborough's journal and retained information about latitude, longitude, meridian distance, water depths and useful information for ships about sourcing provisions or best places to anchor. A map similar to John Thornton's 1673 map was dedicated to Samuel Pepys, asserting the maritime prestige of the voyage and observations. Narborough's observations and drawings were praised as 'the most judicious and exact of any that met before him', and the authors boasted that the volume would 'improve both Natural and Mathematical Science'. John Wood's account was also published in 44 pages, in a volume of privateer diaries in 1669 by William Hack 'help out the shortness of Sir. John's relation'.[74] Helen Wallis argues that these published items 'remained for many years the standard guide to the strait'.

An anonymous author in *Philosophical Transactions* positively reviewed the quality of Narborough's journal, writing that the voyages had been undertaken by 'Skillful Navigators, and Faithful Observers'.[75] The review highlighted the precision of Narborough's observations, claiming that the account 'describes and delineates the Coasts of Patagonia and Chili, together with the Streights of Magellan, of which he took most exact Draughts. Finally, it praised Narborough, writing that the journal was proof of his 'excellent skill in the Art of Navigation, as to the Distances, Longitude, Latitude, Tydings, Magnetical Variation etc'. The volume was judged based on its perceived value to trade and commerce, ruling that it contained 'many uncommon and useful Things upon most of the Heads of Natural and Mathematical Sciences, as well as Trade and other Profitable Knowledge'. The second value was its contribution to expanding 'the mind of man'. The review also complimented the scope, suggesting that it offered 'some new reflections in Geography, Hydrography and Natural History'.

There are other hints that the information returned was useful in practice. In 1695 a mariner wrote regarding navigating the Patagonian coast 'we began to stand off from the coast at that distance to avoid to the shallows of the sand that lie in the mouth of the River of Plata'.[76] The mariner was clearly aware of the presence of shallow water and sand banks near the river mouth, which was information that Narborough's crew did not have when they began the voyage. The mariner continued, 'we discover'd very thick smoke which indicated us to believe that there were inhabitants. Tho most part of navigators who have published Relations of their voyages affirm'd that when tho Savages discern the arrival of any vessels, they usually make great fires'. He didn't specify which 'relations' these were, but Narborough referred nine times to fires made by indigenous

[74] 'Captain Wood's voyage through the Streights of Magellan etc' in *A collection of original voyages printed by William Hack* (1699)
[75] 'An account of several late voyages and discoveries to the south and north towards the Straits of Magellan, the South Seas, the vast tracts of land beyond Hollandia Nova, etc. Also towards Nova Zembla, Greenland or Spitsberg, Groynland or Engronland, etc. by John Narborough; Jasmen Tasman; John Wood; Frederick Marten' *Philosophical Transactions,* Vol. 18 (1694) pp. 166-168
[76] AND/47, National Maritime Museum

peoples living in Patagonia and in Chile, and he used fire to communicate their presence to people living near or in the places the ship landed. At Port St Julián, Narborough wrote, 'Mr. Wood returned aboard and acquainted me with what he had seen [referring to indigenous groups that Wood had seen]. This Night we saw a Fire in the Hills. It blew hard to Night at West'.[77]

Information collection skills

Narborough and his crew returned with 3 volumes of observations and maps, but how was this information collected? How was it recorded? What skills did the crews need to make observations and what does this indicate about skills required to build knowledge to extend Britain's imperial trade and reach in the Americas? The natural environment in the South Seas forced mariners accustomed to Atlantic, Caribbean or European navigation to leave their comfort zone of European navigation, and to adapt to new environmental conditions, use new techniques and instruments in different ways. This included taking celestial observations in the Southern hemisphere, managing extreme weather conditions, and navigating unusually difficult terrain. This act of adaptation of skills to a new environment resembles the process that Nuala Zahedieh identified in copper mining in the Caribbean in the same period.[78] It demonstrates how the demands of imperial expansion could put pressure on the existing English knowledge economy, forcing it to adapt and develop to meet new conditions.

Strong skills in trans-oceanic navigation were clearly essential. John Narborough was an experienced officer - he had been made lieutenant in 1666 after serving in the Anglo-Dutch war, indicating that the Crown trusted maritime experience over scientific reputation.[79] Narborough had extensive experience navigating in relatively well-charted regions with published information regarding tides, latitude and the position of rocks, sand banks and other features. Tasks like recording latitude and longitude, measuring water depths, observing tides and other activities were ordinary and quotidian activities. There appears to have been no draftsman trained to produce drawings and maps onboard the *Sweepstakes* suggesting that the existing abilities of the mariners were considered sufficient. Additionally, the responsibility to collect data was not assigned to an individual – but was collected by a range of crew members, suggesting that their existing skills were trusted. Although Narborough issued instructions to Captain Fleming, he did not describe a method or a system for recording the information, and the differences between the journals suggest that a method was not imposed.

[77] *An Account[…] By Sir John Narborough* (1694), p. 50

[78] Nuala Zahedieh, 'Colonies, copper and the market for inventive activity in England and Wales, 1680-1730', *Economic History Review*, 66 (2013), pp.805-825

[79] Narborough served in merchant ships in the 1650s and 1660s on voyages to St Helena and one to Guinea. His first commission was as lieutenant in 1666 on the *Portland,* and he served as lieutenant on six successive ships, including during the naval-battle the Four Days' Battle in the second Anglo-Dutch war in June 1666. Following this battle Narborough was made Captain of the *Assurance,* on which he sailed to the Caribbean in 1667 as part of efforts to counter Franco-Dutch forces. J.D. Davies, 'Sir John Narborough (1640-1688)' *Oxford Dictionary of National Biography,* (Oxford, 2004) http://www.oxforddnb.com/view/article/19776, accessed 28 March 2016

These factors suggest that the mariners' existing skills and experience were considered sufficient qualification for collecting scientific information.

Despite this, collecting scientific information from a largely unexplored and uncharted region by Europeans did challenge their skill sets. Comparison of Narborough's journal with ship logs kept on Admiralty ships indicates that the detail and scope of information that he collected was more extensive and detailed than an average cross-Atlantic voyage. Voyage logs kept in the 1680s included information necessary to quotidian navigation such as measuring longitude and latitude or wind speed, but not geographical description or maps.[80] Comparison with Narborough's own logs from voyages to the Caribbean between 1666 and 1668 reveal that information collection in the South Seas challenged his own skills and practices.[81] They indicate that ordinary navigation laid the foundation for skills needed to collect geographical information in the South Seas, but that additional abilities were necessary.

The journals also indicate that mariners used their ordinary navigation skills in unordinary ways, including to observe depths recorded by soundings, the position of shoals and sand banks, and latitude and estimated longitude recorded using celestial observation or coastal observation.[82] There were six additional requirements: precision, accuracy, repeat observations, cross-referencing navigation sources, geographical description, and making maps and drawings. The scope and volume of observations and the unfamiliarity of the terrain made these requirements more challenging. They suggest firstly mariners and navigators' skills were more complicated and multi-faceted than usually considered and that they played a significant role in imperial expansion beyond just applying their labour, and secondly, that the requirements of imperial expansion played a role in challenging and fomenting human capital development in England. The scale of skill and labour involved in making these observations is another factor which is largely overlooked in the existing historiography of Narborough's voyage.

The routine for recording data rested on the ships' progress rather than a strict timetable. Narborough and Woods made observations throughout the day or night, whereas Nathaniel Pockett usually recorded weather at 12 noon.[83] Times of observations were recorded by the hour, rather than hour, minutes and seconds. Time was probably calculated using a ring-dial whilst at sea and a sun-dial on land, but these calculations of time were certainly not precise. This practice indicates that although observation demanded precision in

[80] ADM51/345, ship logs for Foulcon voyages 1680-82; 1682-84; 1685-88, NMM
[81] Voyages HMS Assurance April-September 1667; HMS Assurance to the Caribbean May 1666-67; Bonadventure 1667-68. BL
[82] Historians of science have recently focused attention on changes in the uses of instruments in the creation of natural knowledge in seventeenth-century discovery, arguing that they became an indispensable part of collecting information. However there has been less focus on the actual mechanics of how these instruments were used and what skills were required to use them. See W.D. Hackman, 'Scientific instruments: models of brass and aids to discovery' in David Gooding, Trevor Pinch, Simon Schaffer, *The uses of experiment: studies in the natural sciences* (Cambridge, 1990) pp. 31-66; Marie-Noelle Bourguet, Christian Licoppe and H. Otto Sibum, 'Introduction' pp. 1-19 in Bourget, Licoppe, Sibum eds., *Instruments, travel and science: itineraries of precision from the seventeenth to the twentieth century,* p. 1 (2002); Deborah Jean Warner, 'What is a scientific instrument, when did it become one, and why?', *BJHS*, 2: 1 (1990), pp. 83-93; Liba Taub, 'Introduction: reengaging with instruments', ISIS, 102:4 (2011), pp. 689-696
[83] MS Sloane 819

calculation, accuracy was restricted by the nature of the instruments, and the unfamiliarity of the crew with the landscape and local conditions.

One crucial requirement for surveying was attempted precision. If measurements such as water depths were not precise the observation would be useless. Unlike a normal maritime voyage where depths were measured as needed, surveying a body of water turned an ordinarily quick and straightforward activity into a formidable task. To make a single measurement, a 'lead' or metal weight on the end of a 'line' or rope was dropped into water, and markings on the rope indicated the depth to which the weight fell. At Port Dessire Wood measured '25 fathom water 2 leagues from shoare', which involved calculating the distance of the ship from the shore, and using the lead-and-line to measure the depth. Narborough recorded that a bay in the eastern straits was 'like a deep bay more than ten leagues all along the shoare 30 and 36 fadoms', suggesting that he took numerous measurements spanning the distance of 10 leagues (about 35 miles). On one occasion, Narborough wrote that he made many observations in one day to produce two calculations - 'I sounded often to day, and had fifty and fifty three Fathom'. On occasion the seabed was too deep for a lead-and-line to reach, such as at Valdivia where Captain Digby failed to make a measurement beyond 100 fathoms four leagues from the shore.

When weather conditions hindered data recording they performed repeat observations. In the eastern straits, Wood recorded 'we wayed with the wind ENE but it proved hazey so we came to anchor againe at 10 it cleared up and we wayed with the tyde of floade water under foot this day we pased the first and 2nd narrow and at night came to an ancker in 8 fadam water under Queen Elizabeth Island'. The number of recorded depths increased in areas of specified geographic interest, such as Port Dessire and San Julián. Furthermore the ship was not bound by usual commercial constraints of efficiency, granting it additional time for surveying. In total, including wintering at San Julián, the two ships spent 233 days or 7.5 months in harbours and sailing through the straits. Extreme weather conditions also forced the *Sweepstakes* into situations they were not used to. Today the temperature in San Julián region today are between 5°C and 0°C in the winter months May to September, however the Southern hemisphere experienced a cooling period between 1675 and 1898, suggesting that in 1670 it was colder than 5°C.[84] This probably made the region to the south of San Julián very difficult to navigate in winter months due to freezing temperatures, high winds, snow and ice towards the Straits.

Another task requiring precision was recording locations. This involved calculating the exact longitude and latitude of ports, their position on coastlines, as well as entrances to bays and inlets. Navigators usually measured longitude and latitude to record progress of a ship, not in order to map locations. Latitude was

[84] Araneda, A., F. Torrejón, M. Aguayo, L. Torres, F. Cruces, M. Cisternas, R. Urrutia 'Historical records of San Rafael glacier advances (North Patagonian Icefield): Another clue to 'Little Ice Age' timing in southern Chile?" *The Holocene* 17:7 (2007), pp. 987–98

calculated by measuring the angle of the sun's altitude using a quadrant or cross-staff.[85] At San Julián harbour, Digby wrote, 'I found by severall observation of the suns meridian altitude taken with a quadrant of 4 foote radius to be exactly 49-14 one of which was taken june the 9th'. In order to produce a useful measurement, Wood needed to be precise in both handling the quadrant and reading the sun's altitude, which also demanded mastery of mathematical calculations to turn the reading into a figure of latitude. Digby claimed that he calculated the position 'by severall observations', suggesting that he used the quadrant numerous times in order to improve accuracy by checking the calculations against one another. In total, this single recording of latitude of San Julián involved the skill to operate the quadrant, to repeat observations, and the time required to set up the instrument and perform multiple observations. Digby also made calculations when recording longitude of San Julián, writing 'I found by severall observations to bee neare 75-degrees or five hours diference of time; one of which observation was by a conjunction of the moon and mars […]at 44 min past midnight'. When combined, these calculations of latitude and longitude provided a precise geographical position of San Julián. It was the result of the deployment of technical instruments, celestial observation by sight, and multiple observations, and highlights the scale of labour, skill and experience involved in recording just two pieces of information.

Latitude and longitude were also recorded at dangerous sand banks and shoals. At river Gallego, Digby recorded that 'the shoale is in the lat of 51:38 and the Bay runs to the lat of 51 and 46.' Unlike quotidian navigation, which aimed to successfully find a route using a set of existing information, Narborough and Wood were navigating in relatively unknown territory. Although they used the same instruments and methods, they were recording the information to ascertain and record their position, rather than check against existing calculations. The higher likelihood of error, of losing their way and the need to make virgin calculations to forge a route presented a context in which their existing skills had to be used in a different way.

Another challenge for mariners accustomed to northern hemisphere was to make celestial observations in the southern hemisphere where the position of the sun differed to measure latitude and longitude. Blundeville wrote that to calculate the position of the sun in the southern hemisphere 'you must adde the same [the declination that had been calculated] onto the foresaid height, and by such you shall have the height of the equinoctiall above your horizon, which being subtracted from 90 remaineth the true latitude of that place'.

[85] As described by John Davis, a quadrant was 'the fourth part of a circle, containing 90 degrees, and representeth the distance between the horizon and zenith' and were small and quite simple instruments. However, contemporary navigation manuals were not in agreement regarding the utility of a quadrant. In *Arte of navigation* Cortes writes that the Wright's sea-quadrant was useful. In *Seaman's secrets*, John Davis argued that a traditional quadrant was no use in calculating the sun's meridian at sea. Historian David Waters argues that quadrants were little used because of lack of accuracy in measuring geographical positions, whereas J.B. Hewson writes that the Davis quadrant became the principal instrument for observations due to the greater accuracy of the instrument. Digby did not state what type of quadrant he used to make the observation, but his comments confirm that a quadrant was used by at least some mariners in mid-17th-century navigation

Seamans Secrets also included tables of the sun's declination.[86] It explained, 'first seeke the month, then the yeare of our Lord, and the day of the month, and right against the day of the month […] is the suns declination'. He provided an example for using the table, 'the 10th day of March 1651. I desire to know the suns declination in March I look for it, and find it over the third great column and right against the 10th day I finde 00 degrees and 00 minutes South declination, and the like is to be done for any.' Digby made the calculation of the latitude of San Julián harbour on 9 June 1670. According to the table, on 9 June 1670 the declination of the sun was 23 degrees and 31 minutes. Digby would have had to add the declination of 23 degrees to the observed altitude and subtract from 90 in order to calculate the latitude of the harbour. He continued,

> This afternoon I took an azimuth, and find six degrees ten minutes variation easterly […] Nebeles Major was very visible in the heavens, and seems to be a piece of the Milky way, broke from it; the Southern Constellations appear, which are near the Pole Antarctick, the Camelion, the Bird of Paradise […] no Pole-Star not any star fit for observation to be seen within 15 degrees of the Pole, the Crosers Star, of the first and second magnitude are good for observation.

Narborough, Wood and Digby also used new skills to record tidal changes and flows. Digby warned pilots about dangerous tides at the mouth of river Gallego: 'The ebb lest to the SE and runs pretty strong, and the flood is the NW: it is high water as 10 of the clocke, full and changes Var 17 deg Easterly.' Digby also described tidal conditions at Port Dessire, writing 'The flood comes from the S, at the shore it ebbs and flows 3 fathom'. Methods in manuals for calculating the moon's position in the lunar cycle only applied in regions with recorded tide times to make a tide table (*Seamans secrets* showed only British tides).[87] Without tide tables for the South Seas, Narborough and his crew had to make their own calculations. This involved observing the movement of the water to estimate times that the tide changed, as well as measuring water depth from the ship at different times during the tide. Recording the direction of the tide involved observing the movement of the water to orientate the flow of the water.

Mariners also cross-referenced multiple sources of information with new observations to identify and correct errors. 64 leagues westwards from the Cape Verde islands, Wood wrote,

> all this day we expected to see one of the islands Easter Trinidade or Acention but could see neither. By my reckoning I sayled by a Duch draught printed 10 leagues to the eastward of Acention and by an English draught 30 leagues made by one welch but by one of mercators leagues the Hollands draught maketh the land lye 100 leagues more to the westward then our English one.

[86] Davis, *Seamans secrets*. Leap years meant that the same table of sun's declination could not serve for every year and they had to be recalculated every 24 years, according to Blundeville. The table is divided up by month, January-December, and for each month, there are four columns with six years on four year cycles in each. For example, the first column in 'January' shows 1649, 1653, 1657, 1661, 1665 and 1669. Each column includes three smaller columns divided into day of the month, angle of the sun's declination, and minutes

[87] Davis, *Seamans secrets*

To conclude that information was incorrect, Wood navigated with Dutch and English charts, and made new observations to determine the origin of the error. Narborough also diagnosed geographical conditions after studying errors:

> I find great difference within this 48 hours between my dead account […] and the observations I made these two days when the sun was in the meridian: for I find I have gone more southerly by 12 miles than the log allows, I cannot perceive any variation, and the log is well-kept, and the half minute glass good, I judge the current sets to the southward, now the winds are at the east, and the moon near the full.

This highlights how navigators combined methods and sources to navigate the region, at times relying on a common sense interpretation of the landscape, at other times using Dutch, English or Portuguese maps to cross-check information.

Narborough and his crew also described geography by recording their subjective impressions of the region. This information provided a more detailed understanding to officials who would never visit the region, but it was also useful for mariners - celestial observation was not always possible and additional clues were commonly used to gauge location and determine local conditions. These subjective descriptions contrasted with the technical observations made using instruments, but they provided essential information for understanding the nature and appearance of the South Seas.

Analysis of natural matter dredged from the sea bed using a lead-and-line was used to describe the local environment. At 682 leagues south of St Jago, Wood recorded, '2 miles from heare we found the sea water to wax pale and at noon we sounded and found 55 fathom a sandy ozey ground not much unlike our former soundings had black and red mingled'. Wood described the matter by reference to colour – the sea water was white like wax and material was red and black – and texture - loose and wet sand. Narborough also described a variety of colours and textures. At Port Praia in Brazil, he described samples as 'dark black Sand wth some bright fine Sand in it', or 'red Sand inclining to gray at 70 Fathom'. Seaweed was also described - Narborough found 'several Beds of Sea-weed driving to and fro in knots; these Weeds are five or six Fathom long, in strings, with broad leaves on them of a brown colour, at the root hangs a Clod or Rock of 2 or 3 pound weight'. Although simple, these descriptions were performed alongside the multitude of other observations and required a subjective visual and material analysis of material to produce useful descriptions.

The visual topography of the land, in particular the appearance of hills and cliffs from the sea, was also an important guide. Narborough observed 'spiere trees grow much in this wood', 'mountains and snow hills high' and 'good fishing with nets'. When describing how to find San Julián, Wood wrote, 'the land betwixt these 2 lattitudes is low and even without humack or hill it haveing all white clifs to seaward; whereas the land to the northward or the harbour for 2 leagues is full of humackes and hills the highest'. These descriptions were designed for a navigator to match with the observed landscape. Wood advised mariners to line up natural

features in a line-of-sight to determine when to sail ships into harbours - 'the white spots in the hill noted with the same marke when those are one in another, you may run in'. He also offered descriptions of hills to identify when a ship would hit a sand bank - 'for that markes to know when you are on the bar there is to the northward of the harbors mouth sertane whiteish clifes which seem to be an island when the midle of these clifes & a valley or sadle in the land behind them are one in the other, then you are on the bar'. Wood used the height and shape of the hills to write the geography of the port, adding to the precise calculations of latitude and longitude or water depths and location of shoals. Digby and Narborough described rocks as visual indicators of ship location and to aid in setting a course. It required observations of the landscape, identification of the position of rocks, and ability to meaningfully describe them. Digby described Cape Deseado in the northern straits by referring to '2 rocks like the needles.' Modern-day photographs show that two hills like a camel's hump form the end of the peninsula, suggesting that he was referring to the appearance of the peninsula, rather than warning that there were two rocks in the sea that posed danger to ships.[88]

In January 1670 Narborough wrote, 'all the albycores, bonettoes, and flying-fish have quite left the ship; no fish to be seen but whales'. This was not only an act of curious observation - descriptions of animals, fish and plants helped mariners determine location, and required maritime experience to identify relevant information. Narborough identified and named some animals and fish he saw around the ship. Albycore (albacore – a species of tuna) and bonettoes (bonito) can be found in the Mediterranean, meaning that Narborough was probably familiar with them. Flying-fish are found only in tropical waters making it less probably that Narborough would easily identify them. This localised information could give extra clues to future mariners, however these comments were few in relation to the higher volume of navigation detail.

As described earlier, Narborough and his crew made maps and drawings. These were produced using largely the same data as in the journals, indicating the versatility of the information. Analysis of the detail suggests that the makers spent significant time turning observations into cartographic form as well as designing them, indicating application of labour and careful skill. Bays, inlets and shoals and coastal outlines on the three ports had to be plotted and drawn according to latitudes, longitudes, water depths, positions of rocks and other geographical features measured. In the case of the Straits this was particularly important due to their complicated shape and the restricted route caused by the narrowness of the straits and the numerous islands and inlets. Drawing them onto a map required understanding the entirety of the coastlines in order to plot each section relative to each other in scale and relative to other information such as rocks, banks and inlets. It seems probably that drawing the coastline was first, followed by plotting of information within the waters, such as

[88] https://www.google.co.uk/maps/place/Strait+of+Magellan,+Chile/@-52.7168194,-74.6798728,15576m/data=!3m1!1e3!4m2!3m1!1s0xbdad5ffe81e44c75:0xa9099702e9f8ce57, Accessed 28th July, 2015. Furthermore, it seems unlikely that the Sweepstakes or other commercial ships would sail close enough to the shore of Cape Diseado or Cabo Pilar in order to ascertain the presence of underwater rocks, mainly because there was no reason to anchor in this unsheltered part of the straits or attempt to go on land at this isolated point of the straits

water depths and rocks. Narborough's map of Port Dessire included over one hundred water depths, one hundred soundings and eight anchorage marks. The arrangement of numbers indicates the rising and falling sea bed and showed to the viewer sailing conditions in a large area on the map. Although the actual task of drawing the numbers onto paper was simple, it required thought in how to plot the water depths relative to each other to give the clearest indication of the water depths in the whole harbour region, and it required turning the textual results into graphic representation. A large number of rocks were also drawn. Whereas water depth marks were indicative of water depth within a general area of water, rocks on a map had to match up to the position within the water, demanding extra precision. As with water depths, rocks marks were simple and easy to plot, but the precision required careful thought and attention.

As naval commander, Narborough was unlikely to have used time at sea to draw uncharted territory and his journals pre-1669 did not include maps. Wood and Digby may have made casual sketches, but it is unlikely that they had responsibility for drawing new territory. Navigation manuals offered guidance in 'plat' or 'card' making and highlight the skill required to produce what would be considered by contemporaries as high quality charts. One chapter about 'making of a sea plat or cardes for the Sea' advised makers to prioritise geographical information over decoration - 'not to paint their cardes as they do, but rather to supplie the vacant places with other necessarie matter […] furnish up all the vacant places of everie head-land or high land alongside everie coast that is needful to be known'.[89] Another manual instructed, 'the sea-chart is nothing else but a lively picture of the earth and water' and stipulated that a true chart contained five 'notable things'.[90] These included coastlines including islands, banks, shoals and rocks; the graduation, a compass role, and scale in leagues. To check accuracy of the scale it advised to '[take] betwixt the points of your compasses just 4 deg. out of the line of graduation which being applied to the scale of leagues must there agree exactly with 70 Spanish leagues or 80 English'.

For instruction in making charts of uncharted territory, Narborough and crew could consult Wright's advice for 'new land never before discovered'.[91] To record new information, Wright instructed,

> mark it well first with your compass […] secondly, you must there take the heighth of the Sun, or of the Pole-star […] which so being done, your ship may sail on her course all that day, til the day following, without losing her way: and the next day mark the land again, and see upon what point it lieth and then take your heighth […] which land you may point out with the in-lets and out-lets, or capes and other signes, which you saw thereupon.

Wright's instructions highlight the complexity of making what would be regarded as a 'true' chart that would prevent a ship from losing its way. This highlighted the dual challenges in charting new territory.

[89] William Bourne, *The regiment for the sea* (1631) p. 54. After the first edition in 1587 the manual was re-printed ten times, including in 1631. It appeared in ships' inventories and in mariner's wills, suggesting that it was used by mariners in the later 17th-century
[90] Wright, *Certaine errors,* pp. 38-9
[91] Ibid, p. 50

It had to produce information that would be useful in the future, but also had to guide the ship on its current course.

The complexity of these instructions suggests that Narborough and his crew's task of making charts of the South Seas required more skill, knowledge and labour than the extant manuscript maps first suggest and than historians' analysis has previously acknowledged. The decision not to recruit artists or trained scientists ('mechanists') to the crew was noted in the first publication of Narborough's journal in 1694. After praising the quality of the observations, the publishers complained 'tis to be lamented that the English nation have not send along with their navigators some some skilful Painters, Naturalists, and Mechanists' noting that the Dutch and French engaged in this practice 'to their advantage'. However, the benefits that a trained artist would have brought to the data collection is unclear, particularly because they would have been highly unlikely to have experience of sailing or of observing coastlines, harbours or measuring distance.

Conclusion

Narborough returned from the South Seas with information that proved the viability of sailing to the Patagonian coast on a cross-Atlantic route from London to the Caribbean Brazilian coast, and sailing southwards to harbours that could shelter ships and act as trade posts due to their size and lack of settlement. He also demonstrated that ships could pass safely through the Straits and enter the Pacific Ocean to sail northwards to access eastern Spanish American coastline ports. The collection of data on the voyage indicates that skills used to build geographical knowledge of empire were not developed in a vacuum by uniquely expert individuals. Mariners' training and experience on voyages were used to record unique useful information. Narborough, Wood and Digby collected information useful for future trade and navigation — marking places for ships to stop, searching for the location of rivers, and describing the suitability of harbours for anchoring. However, the context in which they were working was different to the commercial or naval sea voyages they were accustomed to. The need to apply methods of data collection — repeat observation, systematic recording of data — in unknown and largely uncharted territory, as well as the need to collect information that described the topology and appearance of the land, and produce drawing and drafts that were intended to become the main authority all indicate that the South Seas voyage presented a challenge to the skills and knowledge of the mariners. It forced them to adapt and use their skills in a different way to meet the challenges of the different natural environment. The voyage demonstrates the confluence of skills used in collecting geographical information and extending public knowledge about empire. Understanding the skills applied and developed on the voyage is crucial to understanding the role that commercial expansion and geographical voyages played in contributing to the British knowledge economy. Information was turned into printed maps and texts published in London, making them available to anyone who could afford to buy them. The Royal Society reviewed the texts, and the observations were referenced in a number of texts into the 18th century. This indicates that the

skills and knowledge built by years of practice in a non-traditionally scientific environment facilitated the collection of useful knowledge and its insertion into the collective canon of geographical knowledge in England.

Glyndwr Williams argued that the impact of Narborough's voyage was limited in official and mercantile policies, and that following the voyage elites lost interest in the region. He writes, 'after Narborough's unsuccessful venture, little more was heard about the South Seas in official circles, but interest in England was attracted by the wanderings and adventures on the Pacific Coast of those disreputable marauders, the buccaneers'.[92] This analysis suggests that subsequent voyages were unrelated to commercial ambitions in the region. However, this overlooks the motivations of buccaneers travelling to the South Seas, and does not explain why privateering voyages to the South Seas increased after 1669. Narborough's voyage laid a foundation for greater geo-political interest in developing a Spanish American trade route, and demonstrated to private interests in England that there was a market for information about the region. Narborough's successful navigation demonstrated that the route was still open for exploitation, and that the Spanish had neither secure hand on the region nor flourishing settlements operating a successful commercial trade. It re-inserted Patagonia, the Straits, and Pacific Spanish America into the English geo-political imagination, aided no doubt by the publication of the map of the Straits and later publication of the journal describing tales about the voyage. This imagination was further fed and exploited by buccaneers in the following 20-30 years.

[92] Williams, 'The inexhaustible fountain' p. 30

Chapter 4: Buccaneers in Spanish America

In the two decades following John Narborough's return to London, buccaneers left London to explore and survey southern Spanish America and the western Caribbean Sea. They produced manuscript maps, and printed accounts of their voyages were published in London in the 1680s and 1690s. This chapter looks at three buccaneer voyages to identify their contributions to useful geographical knowledge and the human capital behind them.

Pirates have long featured in histories of the early modern Atlantic. 17th century pirates have sometimes been presented as part of a by-gone era of romantic discovery and swashbuckling that did not belong to the emerging global economy. David J. Starkey describes privateering at the turn of the century as 'an anachronistic activity, an attempt to seek the treasures which had drawn the Elizabeth adventures to the New World'.[1] This overlooks the ambitions of the Crown and merchants who relied on geographical information collected by buccaneers to aid in extending the American empire. Pirates' role in the European war economy has also been assessed. Nuala Zahedieh assessed the business of plunder, arguing that privateering provided valuable start-up capital in poor fledgling colonies such as Jamaica and played a serious role in the imperial economy.[2] Starkey analysed pirate voyages in the early-18th century that operated as de-facto merchant navy ships - he estimates that 1,441 vessels were licensed to operate as privateers in the wars of 1702-13 and 1718-20.[3]

Other historians have focussed on the political and social life of pirates. Marcus Rediker argues that the pirate ship was a laboratory for early experiments with democracy, while John Appelby discussed the role of women in piracy.[4] Pirates have also been considered as scientists, and William Dampier in particular has attracted attention.[5] Joseph Shipman presents Dampier as an amiable figure who complemented raiding and looting with a quasi gentlemanly interest in science.[6] In his account of three privateering voyages between 1700 and 1720, Tim Beattie foregrounds successful financial returns and the quality of maritime endeavour.[7] Diane and Michael Preston present pirates as pioneers motivated to produce information by curiosity about the natural world, thereby overlooking the British market conditions that encouraged and rewarded the production of commercially useful geographical information.[8] These accounts neglect detailed analysis of the geographical

[1] David J. Starkey, *British privateering enterprise in the eighteenth century* (Exeter, 1990), p. 48
[2] Nuala Zahedieh, ''A frugal, prudential and hopeful trade'. Privateering in Jamaica, 1655-1689', *Journal of Imperial and Commonwealth History,* 18:2 (1990), pp. 145-68
[3] Ibid, pp. 89, 113
[4] Marcus Rediker, *Villains of all nations: Atlantic pirates in the Golden Age* (Boston, 2004); John Appleby, *Women and English piracy, 1540-1720: partners and victims of crime* (Suffolk, 2013)
[5] See Geraldine Barnes and Adrian Mitchell, 'Measuring the marvellous: science and the exotic in William Dampier' *Eighteenth-Century Life* 26:3 (2002), pp. 45-57; Anna Neill 'Buccaneer ethnography: nature, culture, and nation in the journals of William Dampier' *Eighteenth-Century Studies* 33:2 (2000), pp.165-180; Gary C. Williams, 'William Dampier pre-Linnean explorer, naturalist, buccaneer' *Proceedings of the California Academy of Sciences* 55:11 (2004), pp. 146-66
[6] Joseph C. Shipman, *William Dampier: seaman scientist* (Kansas, 1962)
[7] Tim Beattie, *British privateering voyages of the early eighteenth century* (Suffolk, 2015), p. 3
[8] Diane Preston, Michael Preston, *A pirate of exquisite mind: the life of William Dampier* (New York, 2005)

information collected by buccaneers. Important maps and observations returned to England are mentioned but without specific detail. Information about the buccaneers' routes are even lacking, with their long and complex voyages reduced to 'their usual sphere of operations was the Caribbean […] forays around the Isthmus […] on to the thinly defended coasts of Chile, Peru and Mexico'.[9] However, recently Beattie described buccaneer voyages of 1680s-1690s as 'voyages [that] contributed significantly, through observation, captured Spanish 'waggoners', and the published journals of Dampier, Ringrose, Cowley, Wafer and Ayres, to knowledge of the South Sea and its harbours which was to prove vital, despite qualms about its accuracy, to the cruising voyages'.[10] This chapter builds on Beattie's interpretation to analyse the contributions to knowledge in these journals and maps and the buccaneers' role in the useful knowledge economy.

Buccaneers had been raiding the Caribbean seas and Spanish empire since the late-15th century — Francis Drake and Thomas Cavendish were after all considered pirates — but the real heyday of privateering was in the 1680s and 1690s, propelled by the instability and opportunities provided by the Nine Years War and Franco-Dutch Wars. Pirates set out from Europe to the Americas to take advantage of power vacuums caused by conflict to raid ports and steal goods to sell. The raids on Panama in 1668-71 by Governor of Jamaica Henry Morgan are testimony to the significant resources privateers could mobilise, and the geographical access they gained by acting outside of the law.[11] Although Jamaica's nurturing of pirates was put to an end by Governor Thomas Lynch's agenda to bring law to the fledging colony, piratical voyages continued through the region. It is difficult to estimate the total scope of privateering during the period, but high-profile voyages that returned geographical information were undertaken by buccaneers including Bartholomew Sharpe, William Dampier, John Coxon, Lionel Wafer, and Basil Ringrose.

Privateering was not homogenous - John Strong's voyage to the South Seas in 1689 was similar to a merchant or naval voyage, whereas others were violent expeditions that attacked Spanish settlements, or ransomed ships as in the case of Bartholomew Sharpe. Many privateers made multiple voyages over the course of many years, mixing and matching crew mates — William Dampier sailed with both Bartholomew Sharpe in the Caribbean in 1679, and Captain Swan and Captain Cowley on a voyage to the South Seas in 1683. Others re-visited the same region, for example Henry Morgan in the Caribbean. As will be seen, this re-visiting enabled pirates to build unusual expertise of the region, but pirates also returned different qualities of information.

Buccaneers were sitting on a wealth of commercially valuable information. The costs to privateers of collecting and recording natural information were in all likelihood zero. Whilst at sea or crossing land in search of treasure, ships to sack or ports to raid, privateers could simultaneously observe useful information. This information was instrumental to the success of their voyages — if they could not navigate a port or sea coast,

[9] Glyndor Williams, *Buccaneers, explorers and settlers: British enterprise and encounters in the Pacific, 1670-1800* (Aldershot, 2005), p. 31
[10] Beattie, *British privateering,* p. 42
[11] Zahedieh 'A frugal, prudential and hopeful Trade' p. 149. Jamaica was a central node in the pirate world, and following 1655, buccaneers sacked 18 cities, four towns, and over 35 villages in the Americas

they could not reach the locations believed to hold treasure or other wealth. Spanish America was largely off-limits to normal English mariners without risking conflict, but was an area that the Crown and merchants wanted to know more in order to serve growing economic and political interests.[12] But, under the guise (and sometimes reality) of illegality, privateers could sail there. This ability became more highly-valued in the 1680s and 1690s as British interests in Spanish American intensified and French abilities to trade in the region materialised. These shifting circumstances incentivised privateers to exploit their ability to collect and sell geographical information - they were opportunists who took advantage of the growing interest in the region. Although privateering was seen as a threat to State interests, including by the Board of Trade who after 1696 tried to curb piracy, the information returned by privateers and the tacit support of some including purchases of pirate geography books, suggests that their relationship to the state was more complicated.[13]

This chapter focuses on information collected on three series of voyages by William Dampier, Bartholomew Sharpe, Basil Ringrose and others in the 1680s to the Caribbean and the South Seas, and by John Strong to the South Seas in the 1690s. They collected information about three areas of trade interest to England: the Caribbean including the Isthmus of Darien; the Pacific coast of Spanish America; and Valdivia and the southern navigation between the Atlantic and Pacific Oceans. Between 1679 and 1682 Sharpe and crews sailed to the Isthmus of Darien and down the Pacific coast of Spanish American to Chile, returning to the Caribbean via Juan Fernandez Island, a popular stop-over for pirates. During this same period Basil Ringrose undertook a six-month voyage to South Seas via Cape Horn.[14] William Dampier travelled across the Isthmus of Darien to the Bay of Campeche in 1679, and in 1683 recorded his voyage from Virginia to the Southern tip of South America, up the Pacific coast of Spanish America to the Galapagos islands and onto the Pacific Caribbean coast again. Another wave of voyages took place in 1684-88 when John Cook seized a Dutch vessel off Guinea coast, and led a crew including Dampier and Ambrose Cowley into South Sea via Cape Horn. In 1689 an Anglo-Spanish alliance was formed against war with France which temporarily ended (sponsored) plunder of Spanish America, but attacks on French ships were commissioned, including by John Strong in 1689.

Manuscript journals and maps were kept by the buccaneers. Dampier's journal is the most well-known, containing hundreds of pages of observations. He also included accounts by Captain Swan and Lionel Wafers.[15] Ambrose Cowley and John Coxon described the South Seas.[16] On the 1689-90 voyage of the *Welfare* Captain John Strong and commander Richard Simson kept detailed accounts including about the Straits of Magellan.[17] Historians usually regard these journals as dramatised romantic adventure narratives, and certainly they contained some exciting descriptions. Cowley wrote,

[12] For discussion of English affairs 'beyond the line' see Zahedieh 'A frugal, prudential and hopeful trade', p. 146
[13] Ian K. Steele, *The politics of colonial policy: the Board of Trade in colonial administration, 1696-1720* (Oxford, 1968) pp. 42-59
[14] Beattie overlooks that this was a mistake due to high winds
[15] 'Briefe account of Captain Swan's voyage' MS Sloane 3236, BL
[16] 'Journal of John Coxon' MS Sloane 2752, BL
[17] 'Journal of Captain Cowley' MS Sloane 1050, BL; 'Journal of Richard Simson' MS Sloane 86, BL

> where I stood, their came out of the mouth of this cave a large sea dog or beare as they may be tearmed, much like a bear roaring like a bear against mee, I was for the present surprized with the sudden sight and noise of him. I haveing a large pole in my hand, I began to lay on with violence against the supposed devil.[18]

But the journals were largely filled with significant information including about navigation of dangerous or difficult ports and harbours. Unlike in a ship log, Dampier did not record daily standardised observations such as about latitude, water depths, or tidal movements. His journal was composed of short narrative descriptions of places along the Spanish American Pacific coast. Although the amount of detail was less than in Narborough and his crew's accounts — it did not describe how to enter harbours, or include water depths or tidal information — he described a greater number of places and the cumulative effect was to give a much fuller impression of the coastline. Cowley's account of the Pacific coast was recorded in monthly entries between October 1683 and November 1684.[19] In contrast, Ringrose and Strong recorded information about the daily course of the ship. These journals contained information recorded over the collective time of 13 years when they were all at sea. The volume and scope of information was immense and unusual in contrast to the ordinary trans-Atlantic commercial or naval voyages that usually followed strict schedules repeating the same or similar routes each time. It was partly this time that buccaneers spent at sea that made them such effective information-gatherers.

The journals had many images — Dampier made 20 drawings of places in Mexico and Panama and three in the Pacific, including of hills and volcanoes, and harbours.[20] Ringrose made 11 drawings or maps, and 39 prospect drawings of headlands, coastlines and islands. He also made a 'South Sea Waggoner' of images, claiming that they were from Spanish originals.[21] This atlas mixed textual descriptions with 109 prospect drawings, 27 drawings of islands and 35 maps of ports, including Acapulco, Panama Bay and the Straits of Magellan. Most of the maps included useful navigation information, including depth marks, sand shoals and detail of bays and inlets.

The buccaneers also used their privileged status to steal information. In a well-known incident, Bartholomew Sharp succeeded in stealing a derrotero, or pilot atlas, from the *Santo Rosario,* a Spanish ship that the buccaneers attacked at La Plata in July 1681.[22] The derrotero was brought back to England and given to James II in return for clemency. Multiple copies were made and although contents varied, they usually contained

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[18] 'Journal of Captain Cowley'

[19] Cowley explained that he wrote in this manner because he left his journal on board a ship, suggesting he was forced to abandon quickly. Ibid.

[20] Dampier drew 'Rio Lexa' in Mexico; volcanoes at St Michael, Domino Alto, San Salvador, Guatemala; and harbours at Tehuantapec, Ventosa, Gallinas and Porto Angulo on the Mexican Pacific coast. 'The adventures of William Dampier with others who left Captain Sharpe in the South Seas and travelled back over land through the country of Darien June 1681', Sloane MS 3236, BL

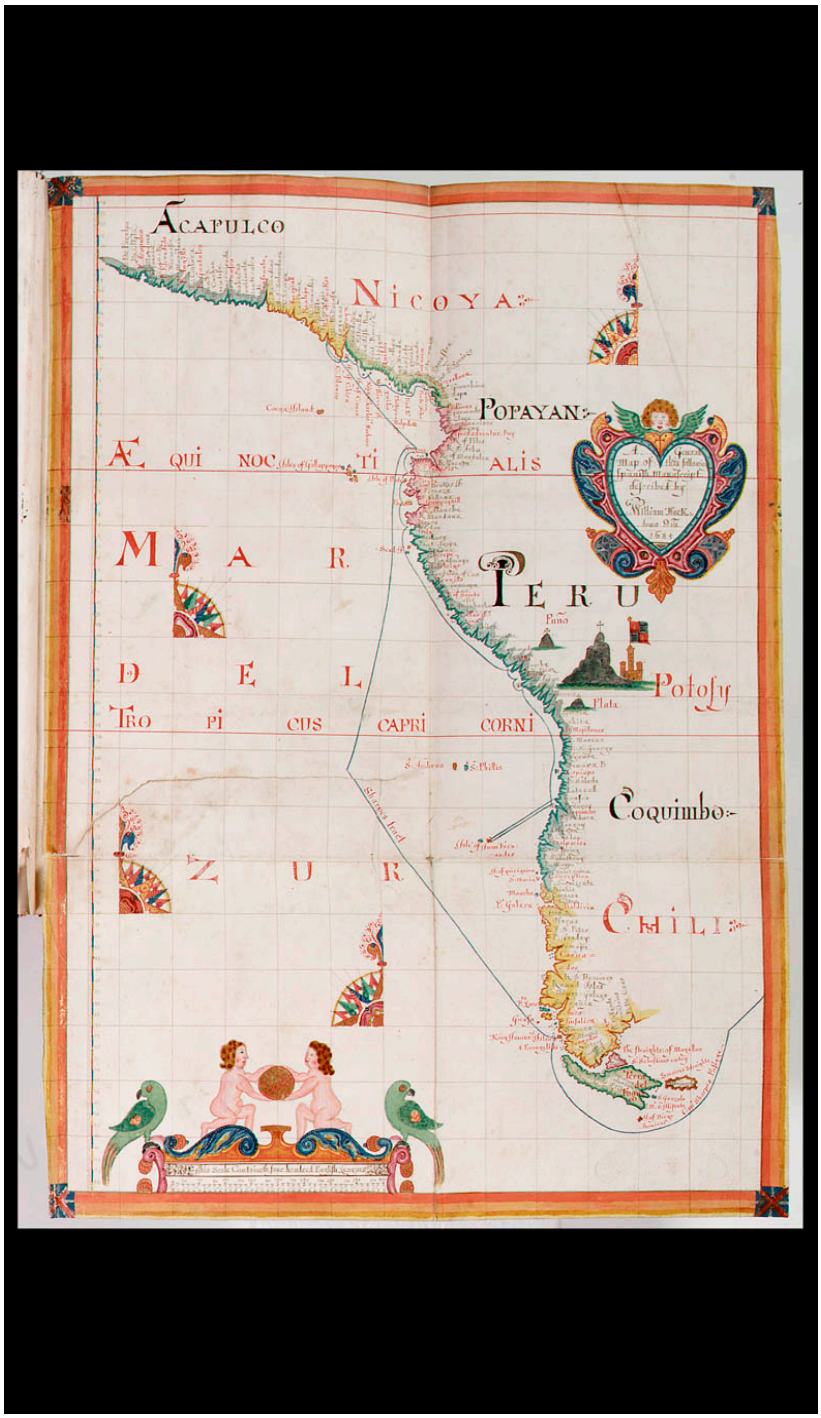
[21] Basil Ringrose, *South Sea waggoner,* MS P32 National Maritime Museum, Greenwich. Derek Howse and Norman J.W Thrower published an edited copy of the Waggoner in 1992, *A Buccaneer's atlas: Basil Ringrose's South Sea waggoner: a sea atlas and sailing directions of the Pacific coast of the Americas, 1682* (California, 1992). In addition to transcribing sections of the manuscript, this volume made useful contributions to our understanding of the context of Ringrose producing the Waggoner from Sharp's stolen charts. They did not however discuss the contributions made to useful knowledge in trade and expansion terms or assess the importance of the information relative to other information recorded by buccaneers

[22] This incident is well-documented by historians. See O. H. K. Spate, *Monopolists and freebooters* (1983) p. 144

around 150 drawings and maps of the Pacific and Atlantic coasts of Spanish America, including Valdivia and the Straits of Magellan.[23] The detail granted to England by the atlas indicates the significant power of buccaneers to collect unique geographical information in Spanish America.

[23] Hack, *South Sea Waggoner*. Each copy was hand-copied and coloured by chart-maker William Hack or an employee, and varied in content. This copy in the National Maritime Museum contains 148 drawings, many of which are very decorative with gold gilt and bold green, red and yellow colours, as well as large and elaborate compass roses

Figure 18: Map of Spanish American continent, Hack atlas, 1685[24]
Reproduced with permission of National Maritime Museum, Greenwich, UK



[24] P/33(1), NMM

This chapter demonstrates that pirates made contributions to useful knowledge of empire that would not have been possible on ordinary maritime voyages. It identifies that pirates used quotidian maritime and navigation skills to record information, but that they were able to access geographical sites that were off limits to ordinary mariners who could not circumvent legal restrictions on entry to foreign territory. Similarly, the economy of privateering – relying on stealing goods, raiding settlements or carrying out contracts – allowed pirates to spend long periods of time in the region unbound by commercial constraints of American voyages. This gave the buccaneers greater opportunity to develop expertise about regions and to observe information, some of which therefore exceeded the detail and scope of information collected by Narborough. However, the information collected by pirates was less comprehensive and systematic than Narborough's observations or than a scientific survey of Pacific Spanish America would probably be. It did not follow a programme of observation. It depended upon the buccaneers' itineraries, including places they hid from other ships. The information recorded was a secondary product of their first aim which was to make profit. This demonstrates the drawbacks of relying on private agents to produce reliable geographical information. Their contributions contributed to the development of empire through adding to geographical understanding of these new markets. The chapter suggests that, rather than being separate spheres of activity to the state-sponsored information collection seen in Narborough's voyage or the requests for information to colonial Governors from the Board of Trade, the privateers were serving the same demand for information and they played a sometimes paradoxical role in the developing commercial interest by British elites in Spanish America.

Isthmus of Panama and North Pacific ocean

The Caribbean and Isthmus region had long been of interest to English traders and buccaneers due to its importance in Spanish trading. Cartagena was a key Spanish port and settlement, and Acapulco was a key hub in the Manila-Potosi Spanish galleons route. European explorers had tried to visit the region since the 16th century as parts of efforts to seize control of Acapulco to take over the Manila trade, including by the Dutch in 1624.[25] The Isthmus served the same function to mariners as the Magellan Straits — a convenient (relative to other passages) Atlantic-Pacific throughway. However, the terrain was geographically challenging – swampy and with difficult coastline – and its position at the heart of the Spanish empire made it difficult to access unnoticed. Pirates were in a good position to launch raids on the Isthmus using nearby Caribbean islands or hideaways in coves and inlets. Henry Morgan led expeditions of pirates there in the 1670s and successfully sacked Portobello, eventually reaching Panama.[26] In 1680 John Coxon, and companions Bartholomew Sharp, William Dampier, Basil Ringrose, John Coxon, and Lionel Wafer (and some 330 other men) plundered Portobello and crossed the Isthmus to reach Santa Catalina on the eastern coast of Panama (called Golden Isle by the buccaneers). After attempted attacks on Spanish ships, the buccaneers sailed south before returning to

[25] Arturo Giraldez, *The age of trade: the Manila galleons and the dawn of the global economy* (Lanham, Maryland, 2015), p. 83
[26] Spate, *Monopolists,* pp. 136-138

La Plata in 1681. A group including Dampier and Wafer seceded from the group and sailed north to Darien, where they recorded detailed descriptions of Huatulco, Tehuantapec and Panama Bay.

Huatulco is a town on the Pacific coast of modern-day Oaxaca province, southern Mexico, about 500km south of Acapulco on the Spanish silver trading route. Dampier described Huatulco as 'the best harbour in all the Coast betweene it'. He identified a large rock on the west of the harbour mouth, claiming it enabled a navigator to locate the usually inconspicuous port.[27] Dampier also described Tehuantapec, about 650km south of Acapulco: 'Tehuantapec is eight leagues from the Muskitos. The coast runs Ne and SW'.[28] He claimed that upon arriving he found the harbour so different from their maps that he felt compelled to make new drawings. His sketch showed the bay with 5 islands hugging the southern side, and a series of hills. Tehuantapec offers the shortest cross-Isthmus route (around 280km) to the Atlantic coast, and was where Dampier's canoes deposited them as they crossed the Isthmus. Although Dampier's focus on the bay was partly a result of the buccaneers' use of the crossing, rather than a concerted effort to collect useful information, it demonstrates how the ambitions of the buccaneers intersected with the geographical needs of the English state. The Hack atlas also included drawings of Tehuantapec, with three bays, two rivers and three islands in the harbour, and dotted lines indicating shoals. They included the note, 'From the Sallinas to Ventosa is 2 leagues. This port is call'd Ventosa [windy] by reason the wind blows stronger continually there then in all the Gulfe and it lies in the middle. From Ventosa to the River of Tehuantapec is 4 leagues & in the Midway stands the Mount of Corbon.'[29] Due to the limited detail, its main use probably lay in joining up with the series of other coastal drawings to form an uninterrupted and linear view of the coastline. Overall this information highlighted that the Pacific trading route had suitable harbours between key trading posts and advised how to locate the ports.

[27] 'The adventures of William Dampier'
[28] Buccaneers often anglicised the spellings of Spanish place names, replacing 'h' with 'g' or changing 'o' to 'a' — Huatulco became Guatulca and Tehuantapec became Teguantapeque. This uses the Spanish spellings of place names.
[29] William Hack, *A wagoner of the South Sea,* P33 National Maritime Museum

Figure 19: Drawing of Tehuantepec in Hack atlas[30]

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The Gulf of Panama was a significant focus, and at 2400km² required significant surveying to portray in any detail. Ringrose made two birds-eye view maps, one at Garachiné on the Darien peninsula in the Bay of Panama, and one of Punto de Juan Solano and surrounding islands. These maps were 285mm x 290mm in size and 350mm x 290mm and 420mm x 250mm and included a more complicated depiction of the coastline than previously shown, describing bays and inlets, rocks, places to find water, and the route of the ship from the river into the bay. One maps showed Panama City, and marked the route the ship sailed from the river mouth north past Punto San Lorenzo to Panama City and to islands Tabago and Otgavo, illustrating that a ship could anchor at six bays and inlets. In the middle of the bay, Ringrose drew the islands Isle del Rey, El Santo, and

[30] Hack atlas P/33(12), National Maritime Museum, Greenwich, UK

Galera, as well as a smaller archipelago. These features made the drawing more comprehensive than previous presentations.

Ringrose made a further ten drawings of the region. These showed less detail — Cabo Blanco was drawn as just two small hills. It had no other geographical or navigation information, and seemed intended to enable navigators to first identify the Cape from other geographical features, rather than specifically navigate around it. The other nine drawings showed similar detail.[31] Ringrose's *South Sea Waggoner* included maps and drawings of the coast — 14 maps, 46 prospect drawings and 9 drawings of volcanoes.[32] The Hack atlases included 'A true description of the bay of Panama' in a double-page spread map.[33] The outline of the bay was very similar to Ringrose's drawing - with the same curvature of coastline and bays and inlets, and the same ship route, described in the Hack atlas as 'the long prickt line shews our tract from Vallona to the Isle of Perico'. However the drawing had additional rivers, including 'Rio Caneuca' in the south. The most significant contribution was the inclusion of named inlets and rivers, and of islands inside the bay. Ringrose's drawing named Panama City, with 5 other places and rivers and 9 islands — by contrast, the Hack map named 33 rivers and points, and 19 islands in the bay.[34] Understanding the texture of the local geography, in particular rivers and ship-friendly bays, helped navigators and merchants not only understand the location of these ports but also their utility as transit points for trade. In total the atlas contained 54 prospect drawings of the Central American coastline, from Acapulco to Pinas in Panama.

The buccaneers also used their access to Spanish and indigenous information to contribute useful knowledge. In a drawing of Acapulco Dampier claimed 'for your Curiosity and Satisfaction I have here drawn it as the Spaniards have laid it down in their drafts of land'.[35] Although he may have made this claim to boost the perceived quality of his drawings, the cases of pirates stealing information or raiding foreign ships indicate that it is not unlikely that this was true. Sharpe, Dampier and others claimed they were guided through jungles and rivers in the Isthmus in 1679 by a 'native Chief Andreas' and his son 'Golden Cap'.[36] Wafers claimed he spent time as a prisoner of an indigenous group and that some of his descriptions of harbours and towns were based on Spanish journals and pilot books and from questioning prisoners. Wafers described Spanish observations as 'very well laid down as to the Latitude. I found them some time remiss in laying down the depths and soundings and on the West Coast between Panama and Guaplutha […] but on the Coast of Perue which is much frequented with shipping both their draughts and descriptions are reasonably true'.[37]

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[31] Drawings were: Quicarra (Isla de Jicaron), Caño, Punto de Juan Solano, Cabo de Guinno, Puerto de Velas, Punto Burica, Golfo Dulce, Rio Colon, Port of Jacames. 'Journal of Basil Ringrose' Add MS3832, BL

[32] The maps were of Acapulco, Barra de Hibalteque, Amapal de Fonseca, Realajo, Golfo de Nicoya, Los Ladrones, Baya Honda, Costa Fondablo, Las Lesnezuela, Perico, Cerro de Sapo, Panama City, Islas del Rey. They were distinguished by a birds-eye view (rather than the prospect perspective) and navigation detail such as water depths, shoals, and occasional anchor marks. *South Sea waggoner*

[33] William Hack atlas (1683), Sloane MS 46A, BL

[34] These included 'Spring of the Sea', Rio Aguaita, Rio Mache and others.

[35] 'The adventures of William Dampier'

[36] Bradley, *British maritime enterprise,* pp. 452-453

[37] 'The adventures of William Dampier'

Figure 20: Part of Panama Bay, Hack atlas[38]

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Their journals also revealed the limitations of what pirates could record. Many drawings were simplistic depictions of an extensive geographical area. In comparison to Narborough and Woods's drawings of Port Dessire and San Julián, Ringrose's maps were simply designed and lacked detail. Drawings of islands off the coast of Panama, including Gorgona, Gallo and Gorgomilla off the coast of Colombia had little strategic value for traders or settlers but were useful for buccaneers trying to avoid detection. This highlights how buccaneers' priorities to seek hideout places conditioned the information they contributed. Regardless, no other English mariners were able to access Spanish America in such depth.

[38] Part of Panama Bay, Hack atlas, P/33(47), NMM, Greenwich

Pacific coast of Spanish America

After the northern Pacific, some pirates sailed south. The Pacific coast from southern Panama to the southern tip of the continent in Chile formed one of the longest continual expanses of coastal territory in European empire. Running southwards from where Panama meets Colombia or New Granada at the Isthmus of Darien to the tip of Tierra del Fuego in Chile, the coastline adds up to just over 7500km. Not all parts were settled or used by Spanish traders – rather it was a series of developed ports forming nodes, connected by expanses of land that were largely unfamiliar to Spanish traders, with Valdivia and Acapuco acting as bookends. As discussed earlier, the instability of settlement of Spanish America was highlighted by the changing status of Valdivia itself which was almost abandoned in the mid-16th century, following natural disaster, indigenous rebellion and a series of Dutch raids. Dampier hinted at the sporadic settlement of the coastline:

> The Spaniards having such a vast track of land and soe many rich rivers already discovered wherein they now worke have neglected to seeke both this and many more in betweene this and the gulfe which noe question may be as rich as any they have yet discovered. Wee had when wee came from Plata the wind SSW and stood down a long shoare not fearing to be discovered because the Spaniards have noe habitations there.[39]

In total the buccaneers spent around two years sailing the Pacific coast, recording information and drawings about key places of interest and general sailing conditions. In terms of useful knowledge there were two significant features in their accounts and the stolen derrotero – the scope of geographical information of the coastline, and information about safe and effective navigation of ports, harbours and bays. The volume of information in Ringrose's drawings was less, but his maps contained visualisations of entrances to rivers, ports, islands and dangerous shoals. The movements of the buccaneers through this Pacific space then was highly unusual and their recordings of geographical information were unprecedented in English history of natural knowledge.

Dampier recorded the coastline in a sequence from Valdivia northwards ending at Panama City, naming 136 named harbours, rivers, bays and islands, and explaining their location in leagues relative to each previous place rather than an absolute geographical position. He included 23 latitude calculations, mostly of larger ports or harbours.[40] 92 places described were in the Viceroyalty of Peru and Rio de la Plata, and 27 in Viceroyalty of New Granada. The account weighed towards building a geography of the southern part of the continent, specifically in New Granada. In comparison 22 of Ringrose's drawings were of New Granada and 16 of places on the coast of the Viceroyalty of Peru.[41] These were mostly prospect drawings sketched between blocks of text, showing showed pencil outlines seen from the perspective of the sea. Six maps described the bay at Arica, Huasco, Coqiumbo, Ilo, Plata, and Isla Gorgona, which had much greater detail including anchorage marks, the confluence of rivers, rocks or small islands, and shoals. The Hack atlas had the most

[39] 'The adventures of William Dampier'

[40] These were: Concepcion; Rio Maule; Quintero; Coquimbo; Copiapó; Porte Velas; Arica; Lanasta; Pinco; Lima; Gravery (?); Casma; Santa Lyes (?); Trujillo; Isla Lobos de Tierra; Chérrepe; Paita; Isla Santa Clara; Santa Elena; Cape San Lorenzo; Mangrove; Isla Palma; Pinas

[41] 'Journal of Basil Ringrose'

comprehensive coverage of the Pacific coastline, with 99 drawings of the coastline from the northern tip of continental New Granada to Valdivia.

Dampier also described the navigability of ports, islands and bays, with comments about the width of channels relative to a ship's ability to pass through them, safe places to anchor, and warnings if areas were too dangerous to sail. At Concepcion in Chile he advised 'two leagues NE and SW from the mouth of the river is an island called Quimpara which must be shut in with the land on the south side of the river before you may anchor'.[42] At Port of Coquimbo, in Chile, Dampier wrote 'ships that anchor there must run within two cables length of the shoar within the point and then the outermost parte of the Pointe will bare SW and then you will be sheltered from the southerly winds which comely blow'. He recorded the depths of some bays and channels. At Cape San Lorenzo on the coast of modern-day Ecuador, Dampier advised,

> The coast runs from the Cape NE by E to a point which is 9 leagues from thence there is good anchoring all the way. Right off that point is a high ridge and from to manta the coast rune ENE three leagues more […] The village lyes close by the waterside and the anchoring place is right against it where there is good rideing in 6, 8 or 10 fathom […] About a mile to the windward of the roade there runs off a showle above a mile into the sea it beares with Monte Canito N by W and S by E.

Dampier included notes about recognising landmarks for use in identifying location. In the Bay of Buenaventura in modern-day Colombia, a relatively large and complex bay, he wrote,

> the marks to know the river is that the land by the waterside is low but in the country high doubled land and right in over the river is a high hill which appear like a lookout and to the southward of it you will see great black hill which seems to be divided in the highest part of it and to the southward of that is another high hill like a shugar loafe and that is the mountaine of Cally where these rich mines are.

At Cabo San Lorenzo he advised 'it is in latitude 1.00 so being distante from it four or five leagues either to the northward or to the southward it appeared even at the top and the Cape it lefte appears like a great church'. He warned that the area had proved dangerous for ships - 'right against the cape are two rocks called the two fryars and it was there that a very rich ship was once lost and all her treasures'.

He highlighted other dangerous areas. He warned the bay Chérrepe in Peru was 'full of dangerous showles the land is low by the waterside by high by the country'.[43] North of Concepcion, Dampier advised that 'off the point of Humore are severall shoales on which many ships have been lost with the northerly winds which blow there very violent', whilst he advised mariners to only attempt to sail at Topocalma 'in fair weather'.

For key ports or towns Lima, Concepcion, Arica, Arequipa and Guayaquil, he described the ports' layout and how to sail into it. He described Callao as the port by which to access Lima – the capital of the Viceroyalty of Peru – 'a very large bay environed with islands which makes it a very secure porte the depth of water is from 4 fathom to 12 clean ground […] In that port the King's ships always lye except when they are

[42]"The adventures of William Dampier'
[43] Ibid

sent with the Kings treasure to Panama'. Similarly he wrote that at Guayaquil, 'the river open right against the town into a large and Spaniards place at least a league from side to side and as much from the island to the towne. The city is seated close by the waterside, parte of it in a swampe which is sometime overflowed by the river […] there are two forts one close by the water the other on the hill'.

Dampier, Ringrose and Hack included descriptions of Arica and Ilo on the Peruvian coast. Dampier described Arica as a safe harbour where 'ships anchor in 8 or 9 fathom close by the shore where there is very smooth landing'. The Hack atlases included showed the coastline from Mount of Africa to Mount Sama and three named islands at Arica, and river mouths Arica and at Rio Sama. Latitude was marked as 18:45S at Mount of Arica, and 18:00S at Mount Sama, which corresponded with Dampier and Ringrose, and warned that navigators 'must ride where the anchor is drawn & in a clear day you may see the Cordilera Nevada: this port is the embarcadera to very rich mines: Potasi, Puno & Plata'.

Figure 21: The port of Arica, Hack atlas[44]

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Information recorded by pirates about the same place could vary. A description in the Hack atlas claimed 'the Point of Ilo is low land stretching itself out into the sea and off the points are 3 or 5 small rocky islands which lye with the island […] To the northward of this point is the road for Ilo where ships run in and bring the point to windward of them and anchor in what depth they please but the best place is known by takeing a marke from the shoare.' Two maps by Ringrose showed the same coastline curving inwards to make a sheltered bay at Arica, marked with 'Lat 18:40' and two anchor marks with the notes 'rideing for barques' and 'for ships'. It added a shoal between an unnamed island and the mainland which was not mentioned in

[44] P/33(113), NMM

Dampier's account. 21 small islands were drawn between Rio Juan Diaz and Ilo, some of which were in Dampier's account. A single anchor mark was marked in Ilo bay, but without a scale or other markings, it did not determine its actual distance from the shore. Dampier described Ilo harbour as 'a little to the northward of the road which is only a place to shelter boats and small barques, the entrance is betweene two steepe rocks not above 40 yards a sunder being in it a secure place and good landing. The river is almost opposite to the mouth of the harbour'. Ringrose's map did not include this level of detail, and although it showed houses and a church at Ilo to indicate settlement, it did not give instructions or show a harbour entrance. Ilo was described in another drawing, which showed the curve of headland between Ilo and showed an anchor mark some distance from the mouth of the river. It also included the instructions, 'in the port of Hilo you must ride in 12 fathom water that is where the anchor is drawn […] betweene the River of Tambo and the Point of Hilo the currents set in but especially into Tambo'.

Similarly, Ringrose and Dampier both described Coquimbo harbour. Dampier wrote, 'this port lyes in Lat. 30 south NW', and claimed there were six islands in the bay, with the city two miles from the harbour. Ringrose's map showed the location of Coquimbo and Herradura. At Coquimbo he drew three groups of rocks and a shoal, but identified Coquimbo as Lat 30.10. The Hack atlas drawings of Coquimbo had the same shape as Ringrose's drawing, with Herradura bay on the southern end of the bay. However, Sharpe drew five islands, including Isla of Paxaros which are labeled in Ringrose's map but not depicted. It claimed that Coquimbo was at latitude 30:00S, which was .10 of a degree different to Ringrose but the same as Dampier. Hack also marked 'rocks' at Coquimbo Point. Hack's drawing included textual descriptions of the two harbours: 'From the Port of Coquimbo to the Bay of Tongoy is 7 leagues. Coast runs NE and SW, in which bay you must ride where the anchor is drawn, over against a small river, in which is abundance of mejillones [mussels]'.

Figure 22: A description of the port of Coquimbo, Heradura & Tongoy, Hack atlas[45]

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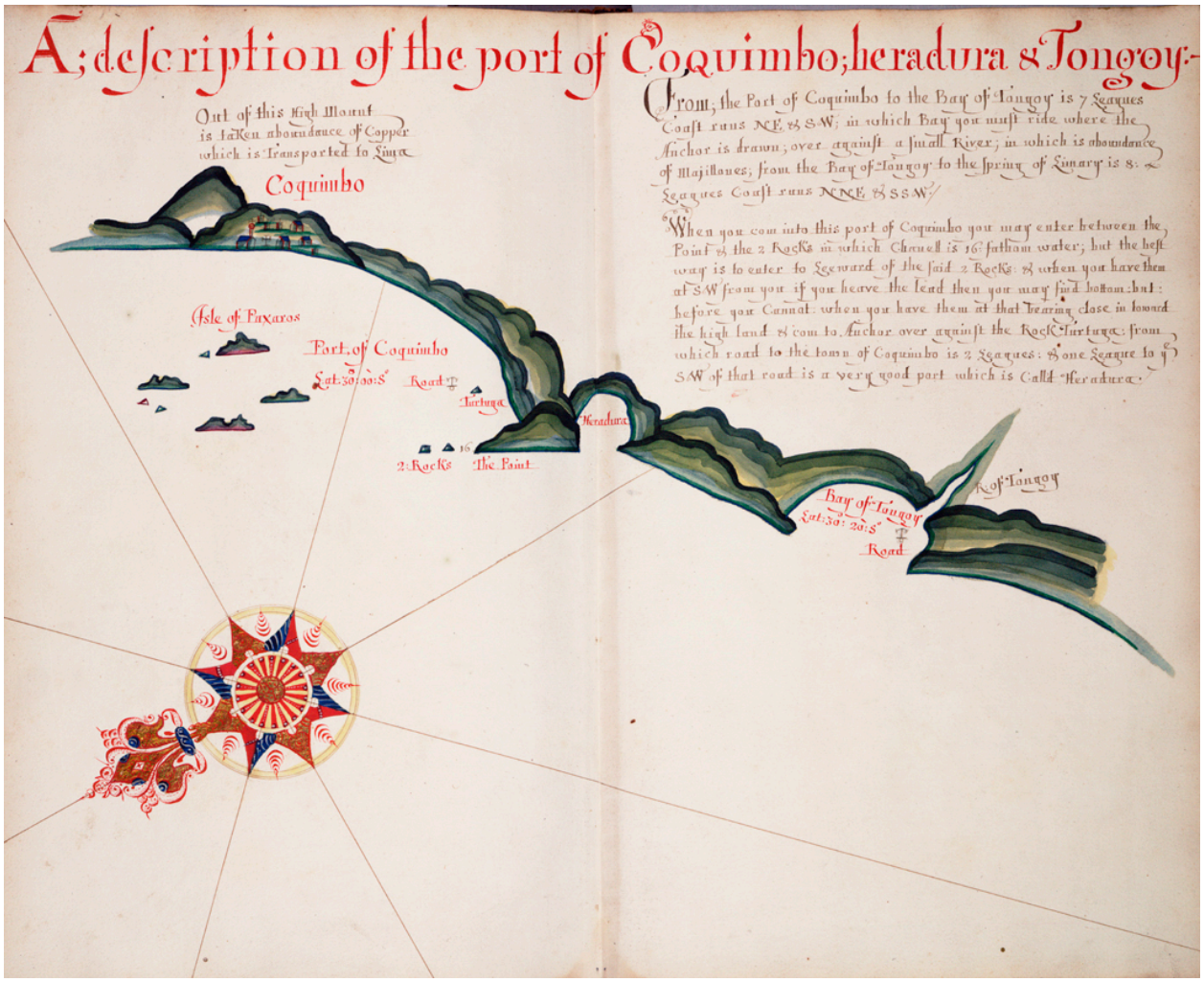

Of the three accounts, the Hack atlas contained the most detailed information about the navigation of Coquimbo:

> you must enter between the Point & the 2 rocks in which Channel is 16 fathom water; but the best way is to enter to Leeward of the said 2 rocks & when you have them at SW from you if you heave the lead then you wall find bottom but before your cannot: from which road to the Town of Coquimbo is 2 leagues: & one league to the SW of that road is a very good port which is called Heradura.

The inclusion of water depths and the instruction to enter the port only when a lead-line could reach the sea floor was the type of useful information that could help mariners navigate a port, but was not included in

[45] P/33(127, NMM

Dampier or Ringrose's account. This highlighted the limited capacities of the buccaneers to survey in detail, perhaps due to only being able to linger on coastlines rather than make repeat or lengthy stays.

Like Narborough, the buccaneers synthesised information gathered from a variety of sources. Before describing the Pacific coast, Dampier explained that when describing places he had not visited, he used information he considered reliable from other sources: 'others neither he [Davies] nor I were at but I have it either out of the Spaniards own writeings and observations or else from the mouthes of some intelligent persons which wee had a board'. On the same voyage, Cowley referred to Spanish information, writing 'wee judging our selves to the Westward of the Rock called by the Spaniards St Bartholomews lying W from Goan-lying N and S in the sea 20 leagues by the report of the Spaniards'.

In a similar manner to the information about Central America, descriptions of the Pacific did not represent the outcome of a full methodical survey of the coast. Instead information mirrored and followed the realities of the course of their voyages. Unlike Narborough's accounts or traditional sea logs, Dampier's account did not result from daily descriptions of the ship's progress — rather he provided a sequence of descriptions of the ports and islands along the coastline, at times supplementing his account with reference to information provided by 'the Spaniards'. He did not mention taking measurements such as latitude and longitude calculations using lunar or solar observation, and he did not include the movement of tides or comprehensive depth markings for a whole bay, instead focusing on depths in a specific place where a ship would find it useful. Ringrose's drawings concentrated on the coasts of New Granada, and although it covered as far south as the Juan Fernandez islands, the higher presence of Spanish soldiers or ships closer to Valdivia probably meant that the buccaneers were forced to spend more time there, and therefore collected less information. The gathering of geographical information reflected the rhythm of buccaneer life, governed by restrictions on movements, opportunism, and inconsistent but sometimes groundbreaking access to territory. Dampier hinted at this economy of information in discussing information about Copiapó in northern Chile: 'this place though abounding with all sorts of provisions yet was never attempted by privateers for it lyes in lat 27 South which is so far from the places for cruising that they have not thought it worth their while'. The exception to this information was the Hack atlas.

Valdivia

A decade after Narborough's visit, buccaneers recorded information about Valdivia. Captain Swan sailed to Valdivia in 1684 with plans to trade in commodities and firearms with Spanish settlers. However, their trading efforts were thwarted by tension with residents — some buccaneers were persuaded to come ashore after being told the Spanish governor had prepared a 'present' for them. Several were killed in gunfire, and the remaining few made a hasty retreat. However they succeeded in recording more information than at other places, suggesting that they understood the geopolitical importance of the port. Dampier used Spanish information in his account — 'I leave the descriptions of these harbours to the gentlemen of my nation who have been there

they being better able to doe it then myself who have nothing but the Spaniards work to take it from which although I can say nothing against the variety of their books yet I have found short in many things which I have often enlarged on'.[46] Although this claim to fill in the gaps in Spanish knowledge was an attempt to assert authority, it is possible that he synthesised accounts to write his own.

Dampier confirmed Narborough's observations about the size and depth of the port harbour, claiming 'the port is very large and may receive ships of the greatest burthen where they may ride very secure". He described two channels at the harbour entrance, claiming that 'the southernmost chanel is reckoned the best which goe in between Moro and Gonsalo and the Island […] There is good anchoring in the channel between the island and the moro'. He advised large ships to avoid a channel on the north of the island, instead suggesting that at Quelo 'this place is good anchoring the land is low and from thence to Tuepall is 9 leagues where ships sometimes anchor though it is a bad forte'.[47] These details gave hints to sailors about how the suitability of Valdivia for sailing.

In June 1690 John Strong recorded his attempts to reach Valdivia from Chile, describing the difficulty of navigating the region and advised where to find areas to sail and anchor. He sent a pinnoco to survey the Bonno river which 'found it to be only a sandy bay and not a place for the ship to ride in'. After leaving, Strong continued that 'about six leagues to Cape Gallera and lyeth SE and NE of another there is no danger within a mile of the shoar'. He described conditions at Cape Gallera – 'in summer a man may enter to ride in a little sandy bay that lyeth about one mile within the Cape M nine or ten fathom sand ground it lyeth open from the West to the North which are the winds as we find doe blow here generally at this time […] Cape Gallera bore SE about three leagues distance and the southernmost land we see SWS the northernmost NE off'. He continued, 'Thursday this morning at one we steered NE to fil the wind at SW and then NN til nine and then NE til twelve. At twelve we see Island of Mocha a bearing north of us about seven leagues we do find by our reckoning that it lyeth a seaven leagues to the northward of Baldivia'.[48]

The Hack atlas contained a large image of Valdivia, with three islands drawn in the bay, nine named rivers, and 20 depth marks ranging between 5.5 and 10 in the southern bay leading up to the fort.[49] The inclusion of depth marks between Point of Galera in the south, eastwards and around Isle of Constantine and Point Gorda offered a safe sailing route into the bay and up to the port. It also described sand banks around 'the Kings Isles' in the middle of the bay, on the approach to Valdivia, and noted that they were 'in length 6 leagues' and advised pilots 'when you enter into this River of Baldivia close to the Mount of S Gonzalo then enter up for all is clean & deep'.

[46] 'The adventures of William Dampier'
[47] Ibid
[48] Journal of the voyage to the Straits of Magellan by the South Seas anno. 1689 in the Welfare Capt. John Strong Commander; some observations on this voyage were drawn by Richard Simson' MS Sloane 3295, BL
[49] Hack, W*agoner*

Figure 23: A description of the river of Baldivia, Hack atlas[50]

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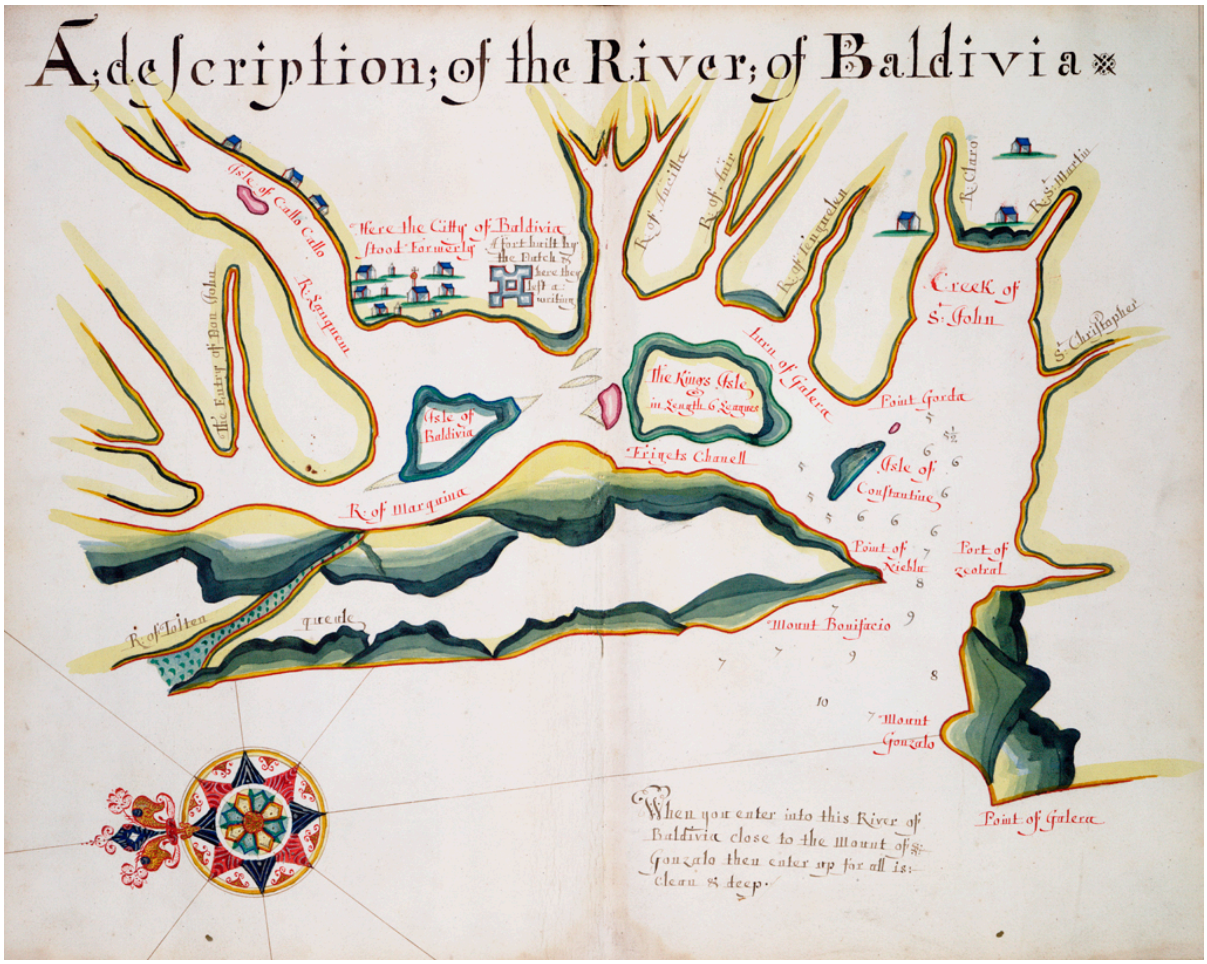

Buccaneers offered judgements about geopolitical advantages of the town. Dampier rated Valdivia as a significant harbour only due to its position as a 'frontier garrison against Chilly [Chile] Indians', rather its fortifications or trading advantages. This suggests that although Valdivia would later become a highly fortified town, in the 1670s it was regarded as a relatively peripheral town in the Spanish empire. Dampier believed the port was unsuitable for trade - he remarked that he thought Ringrose to be 'extreamely besides his mark' for proposing that Captain Swan should trade in Valdivia and Necoya, where Swan attempted to trade after Valdivia, because 'the one being only aggression, the other a most obvose mistake'.

The accounts also made clear that Spanish presence in Valdivia and south of latitude 40 was patchy but alert. In the 1680s, Spain's ambitious rivals did not know the extent to which the Spanish Crown controlled

[50] P/33(142), NMM

the region, and how easy it would be to form successful trade routes, both legal and illegal. The journals recorded the presence of Spanish ships in the Straits of Magellan, as well as the response of authorities at Valdivia to the presence of foreign ships. This indicates that pirates could also offer valuable commentary on geopolitical conditions that would have been otherwise difficult to obtain.

Pacific-Atlantic passage

Successfully navigating a Pacific-Atlantic passage was crucial to accessing Pacific trade, and although the Magellan Straits had been the main focus of Narborough's voyage, it was peripheral in the buccaneers' accounts. Due to the barren nature of the southern passage and the limited-to-absent opportunities for plunder, the buccaneers tried to pass between the two oceans as quickly as possible. This appears to have given them minimal opportunity to record useful information. The buccaneers had some knowledge of John Narborough's voyage - in March 1684, Cowley wrote 'the governor was the same man that detained Sir John Narborough's Lieutenant at Baldivia, when the King sent him into the South Seas to discover what he could'.

In January 1685, Captain Swan sailed through the Straits en route to the Chilean coast. He described the presence of two other ships - one under Captain Eaton 'who came out of England designeing to seek his fortune in the South Seas' and the other a Portuguese ship commanded by a buccaneer who sailed with Sharp. Swan's ship anchored at Queen Elizabeth Island and at Porte Famin to trade with Patagonians, staying for 15 days. He described 'the distance from Cape Virgin Mary at the east entrance of the Straits to Cape Dessire at the west end of the Straits is counted 113 leagues'. The ship's master Josiah Feats calculated 'the longitude between the Lizard and Cape Dessire is 72:45, the difference of time then is 4 houres 5 minutes'.

In 1689-90 John Strong succeeded in navigating the straits. The ship reached the Falkland Islands, and sailed through the straits to Juan Fernandez islands, and returned by the same route. The westward voyage in February 1690 was testimony to the difficulty of navigating the straits, at it lasted three months and twelve days.[51] Richard Simson observed 'a certain imperious Current or Tide in ye narrows, not farr from the Entrance of the said Straits, commonly called the Gulph'. Strong described the geography on the approach to the eastern mouth, writing 'we see Cape Virgin Mary bearing SSE and four in the afternoon the Cape bore WN distance about four miles seventeen fathom water at eight at night we stood to the Southward and lay SW til twelve at night'. He continued, 'we kept the lead going every half hour on the westwide we had twelve fathom & on the southside we had thirty four fathom', indicating the amount of work required to make calculations of water depth. At Cape Virgin Mary he wrote that eight leagues north, they found

> a bluff cliff [where] there is a small sand when you have the Cape bearing N of you about three leagues five fathom water within the cape there is a long point of beech like Dungeness [a headland on the Kent coastline of England] but is bauld to it is about eight leagues over to the

[51] Helen Wallis curiously writes that after the voyage Simson advised that 'no one should attempt the passage in winter'. Of course, February-April in the Straits of Magellan is summer, not winter, so it is unclear where this mistaken advice came from - whether it was Simson's error or whether Wallis confused winter and summer in the southern latitudes. Helen Wallis, 'English enterprise in the region of the Straits of Magellan' pp. 193-220 in ed. John Parker *Merchants and scholars: essays in the history of exploration and trade* (Minneapolis, 1965) p. 212

south side at six at night we had a great storme of wind at SW wee came to an anchor in twenty five fathom water ten leagues with in the Cape on the north side.

He included the compass co-ordinates at each point: 'Wee came to an anchor in thirty six fathom water good ground the tide run nine knots & log that is nine mile an hour but it was spring tides.' Strong's observations filled in some details missing from Narborough's account but overall they were not a significant contribution to knowledge of the straits.

Figure 24: Straits of Magellan, Hack atlas

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The Hack atlas had more information. A double-page drawing showed the straits and surrounding islands, capes and bays - it was one of the most detailed maps in the atlas, drawn from a birds-eye perspective rather than as a prospect drawing. It described the latitudes of Cape St Bartholomew (55:00 S) and of Straights

of Lemaire (54:45 S), and marked Cape Dessire on the eastern end of the Straits and Cape Virgin Mary at the western end. In total it recorded 25 points of interest, including Rio Gallegos which was also described by John Narborough. However, it displayed additional information about areas in the southern straits, including the Straits of Lemaire, Port of Good Success, Isle of Diego Romiras, Mount of St Hifonta and Isle of San Gonzalo. The shape of the straits broadly followed the v-shape recorded by Narborough, however it appears more severe and shorter, and the passage marked 51 small rock, shoals or islands. The accompanying text highlighted distance and location: 'from the Port of San Vicente (I mean the port of Carimapo near the Isle of Chiloe) to the Straights of Magellan is 175 leagues: this straights lyes in the Latt of 52:00S & from thence to the Straights of Lemaire is 75 leagues NW & SE. The Straights of Magellan is in length 110 leagues and the Straights of Lemaire is but 8 leagues from N to S'.

Le Maire Straits

In 1681 and in 1683 buccaneer ships missed the entrance to the Magellan Straits and were pushed further south by strong winds or navigation errors. Dampier claimed that he himself persuaded the captain in late December to avoid the Straits — 'I persuaded the captain if it were possible for us to get water anywhere that we might goe round Terra del Fuego, and not to venture through the Straits of Magellan'. Two or three days later he wrote, 'Wee directed our course for the Straits of Magellan but the winds hanging in the westernboard and blowing hard which often putt us by our top sailes soe that wee could not fetch it'. On 6 January they sailed into the Straits Le Maire, to sail around Cape Horn.

Coxon suggested that they already had access to some information about the passage.

> wee had a journal of a brothers called by name Noddles which was about 65 years ago, sent out to discover those parts of the world with that gave descriptions that they went about Terra Fuego through this straight of Maria and weathered Terra Fuego, and went down the west side and ran down to the northwards and missed the Streights of Magellan and came through into the north sea.

He emphasised that they took several observations of the sun's altitude — 'we wear very exact in takeing amplitudes to be yet more satisfied' — due to uncertainty about their position, variation of 13 or 14 degrees, and 'thick weather' that presumably made observations more difficult:

> wee stood to the SE ESS 700 leagues, and about 3 in the morning we saw breakers very near as under our lee it blew hard […] we went in, hills covered in snow, along the keyside about 4 leagues. I saw a very convenient cove, wee came to an anchor the 30 of November, thinking to stay here til the weather was a little warmer and first night we lost one of our anchor, the cable being very bad.

Following the loss of their anchor and the difficult sailing conditions, the ship stayed in the cove for twenty-two days. The Le Maire Straits are a longer route. Spate maintains that no English mariner had yet rounded the

Horne and only one person before had sailed west to east.[52] These circumstances again highlight the contingency of the collection of geographical information. Although these voyages were the result of a mistake, they produced some valuable observations, offering comparison of the suitability of the two routes between the Pacific and Atlantic.

The most thorough account was recorded by Coxon. At Terra del Fuego he wrote, 'when we observed we were in the latt of 55:30 the wind being northerly and wee to the southwards of the straights road no yet to the northward again, but the captain and master with advice of some others, concluded to goe about Terra Fuego, and so to goe through the new streights, the streights of maria'. Coxon also described islands 12 Appostles and 4 Evangelists as lying 'at the entering of the Streights mouth the current putting westward out of the streights'. The 12 Apostles were drawn to the east of Cape Dessire, and showed two groups of six small islands grouped along the coastline, whilst the 4 Evangelists were at the mouth of Magellan next to Cape Victoria. These islands were not included in Narborough's account of the eastern end of the Magellan straits, nor in accounts of Magellan by Dampier or John Strong, but were shown in the Hack atlas.

Conclusion

Buccaneers made significant contributions to useful knowledge of empire. Information they recorded was published in London in maps and in three volumes of buccaneer accounts.[53] Whereas historians have described these books as 'sensationalist' (*History of the Bucaniers)*, a 'narrative of reformation' (Dampier's *A New Voyage)* or as examples of the ship as a place of scientific discovery, the maps and texts contained detailed and valuable geographical information.[54] A *History of Bucaniers* printed 45 drawings of the coastline from Panama City to the Magellan Straits in the style of coastal pilots and with latitudes and *A New Voyage* included 3 maps with details about the South Seas.[55] One map showed 23 place names on the Pacific coast of New Spain compared to just six names in North America. Another named 81 places in Pacific Central America and 22 between the Gulf of Mexico and Cartagena.[56] Another map showed the Bay of Panama with particularly dense geographical detail, including three large shoals, six ship routes drawn indicating a navigable route in the bay, and 12 water depths.[57] A dotted line showed how Dampier, Ringrose and Wafer crossed the Isthmus and 'the entrance into the south

[52] Spate, *Monopolists,* p. 144

[53] *A new voyage around the world: describing particularly, the Isthmus of America, several coasts and islands in the West Indies, the isles of Cape Verd, the passage by Terra del Fuego, the South Sea coasts of Chilli, Peru, and Mexico,* (1697); *Voyages and descriptions: Vol II. In three parts,* (1699); *The history of the bucaniers of America;* (1695); *A collection of original voyages: Containing 1. Capt Cowley's voyage around the globe. II. Captain Sharp's journey over the Isthmus of Darien, and expedition into the South Seas, written by himself. III. Capt. Wood's voyage thro' the Straits of Magellan IV. …Illustrated with several maps and draughts* (1699)

[54] Richard Frohock uses Steven Shapin's *A social history of truth* to discuss how Exquemelin gave authority to his writing by claiming to be an eyewitness to numerous events. Richard Frohock, 'Exquemelin's buccaneers: violence, authority, and the word in early Caribbean history', *Eighteenth-Century Life* 34:1 (2010), pp. 56-72. See also P. Edwards, *The story of the voyage: sea-narratives in eighteenth-century England* (Cambridge, 1994); William Hasty, 'Piracy and the production of knowledge in the travels of William Dampier c.1679-1688' *Journal of Historical Geography* 37 (2011), pp. 40-54; A. Neill, *British discovery literature and the rise of global commerce* (2002), p. 183

[55] 'A map of the world shewing the course of Mr Dampiers voyage around it from 1679-1691 in *A new voyage around the world* (1697)

[56] 'A map of the middle part of America in *A new voyage around the world* (1697)

[57] 'A map of the Isthmus of Darien & bay of Panama in *A new voyage and description of the Isthmus of America* (1699)

seas' was marked. *A Collection of Original Voyages* traced the route of Cowley's ship and marked the Straits of Magellan and 'Pacifick Sea'. In *Bucaniers of America* a map 'showed a bold line encircling the southern American continent to indicate the route that Sharpe and his crew had taken.[58] However some parts of the publications were vanity pieces. The geographical content of the map was not as impressive as the asserted voyages of Sharpe - Brazil was depicted as a large island, and a large river, 'Rio de las Amazones', separated New Granada and New Castile into two separate landmasses. Ports that had been the focus of Narborough's voyage, such as Port Dessire and Port San Julián on the Patagonian coast, were not depicted. Nevertheless, the texts helped some pirates to create a reputation as pioneers in useful knowledge, particularly William Dampier who introduced *A New Voyage* with a comment to the President of Royal Society that he was a promoter of 'useful knowledge' and he was invited to a meeting at the Royal Society in 1697.[59] Hans Sloane purchased copies of the manuscripts and Edmund Halley used information from Strong's journal in his magnetic map of the world.[60] Robert Harley (Lord Treasurer 1711-1714), promoter of South Sea Company, also owned a copy of Strong's journal.[61] Dampier was later appointed 'Pilot of the South Seas' for the 1708 expedition, and was involved in its preparation.

The geographical scope of these voyages indicates that pirates could cover a similar, if not greater span of territory than 'legal' mariners like John Narborough. In the case of the Caribbean, their voyages and information collection set the stage for the later expedition to Darien by Scottish-backed colonists. Cumulatively, the buccaneers spent a much greater amount of time than Narborough and crew had in the South Seas and Atlantic coast of Spanish America. Privateers recognised an opportunity to exploit the commercial ambitions of British elites and undertook voyages to the South Seas in order to collect information that they could sell or use for leverage in their negotiations with the British Crown. In turn British elites benefitted from a supply of geographical information that was cheaper to procure than paying the costs of a full expedition to collect information. Rather than viewing them as distinct and separate circles of activity, viewing 'official circles' and privateers' activity as overlapping provides a more nuanced understanding of the mechanisms of the market for useful knowledge.

[58] 'Description of South Sea and coasts of America containing ye whole navigation and all those places at which Capt. Sharpe and his companions were in the years 1680 and 1681'
[59] Dampier, *A new voyage,* p. 1
[60] Edmund Halley, *A new and correct chart shewing the variations of the compass in the western and southern oceans as observed in the year 1700'* (1701)
[61] Harleian MS 510, BL

Chapter 5
Companies and useful knowledge: the Darien Expedition and the South Sea Company

After 40 years of growing interest by the English state in understanding South Seas geography, two chartered companies formed to exploit opportunities for long-distance trade in Spanish America and the Pacific. The first was the Company of Scotland, formed in 1693. As part of its ambition to promote 'trade and navigation', it funded a voyage to Darien in 1669 to establish a colony and trade to the East Indies through the Pacific. Another company, the South Sea Company, was founded in England in 1711.[1] Its creation was partly enabled by the shift in European geo-politics following the Spanish War of Succession and the Peace of Utrecht in 1713 that granted the *asiento* - a contract for the delivery of slaves from European supply-nations to Spanish America - to England for 40 years.[2] It represented the first opportunity for English merchants and political elites to legally trade in the South Seas. These companies both used existing geographical knowledge created of the region and stimulated the creation of additional information in London.

Links between chartered companies and science have not been widely documented and neither company has been analysed regarding their links to geographical knowledge about Spanish America or to useful knowledge.[3] However, both hold special places in British and Scottish historiography. In Scottish public memory the history of the seven-month Darien colony produces both shame and defiant pride. To some it represents another attempt by Scots to forge their own destiny in the face of the imperial 'successes' of England, whilst also being a case of spectacular failure that many believe kickstarted a series of events leading to the fateful 1707 political union with England.[4] Likewise the turbulent events of the financial crash in 1720 dominate the historiography of the South Sea Company.[5] The credit bubble and crash were used as recently as the 2008 global financial crash as an example of the consequences of bad financial practices.[6]

For both Companies the focus on these disasters has prevented the meaningful development of other parts of their history. The imperial ambitions behind the Darien voyage are loosely characterised as singular desire for overseas territory to boost the Scottish economy to compete with other European nations, but geo-political or historical reasons for selecting Darien in particular are absent. John Prebble writes 'the Scots saw the Company as a colonising power that would release them from the political and religious tyrannies of the

[1] The full name of the company was *The company of the merchants of Great Britain trading to the South Seas and other parts of America and for encouraging the fishery*
[2] The Company also agreed to buy government debt of £9,471,320 in return for the *asiento*
[3] K.G. Davies, *The Royal African company* (1957); Roper, L. H., and Bertrand van Ruymbeke, eds., *Constructing Early Modern empires: proprietary ventures in the Atlantic World, 1500–1750* (Leiden, 2007). Ted Binnema recently explored the Hudson's Bay Company and scientific networks. Ted Binnema, *Enlightened zeal: the Hudson's Bay company and scientific networks, 1670-1780* (Toronto, 2014)
[4] Douglas Watt argues that 'in 1696 the Scots had experimented with financial capitalism to a degree that many would have thought was beyond the resources of a relatively poor northern European nation […] This was a remarkable event and one that can only be fully understood, it will be argued, if viewed as an early example of a financial mania'. Douglas Watt, *The price of Scotland: Darien, union and the wealth of nations* (Edinburgh, 2006) p. xviii
[5] For histories of the South Sea Company, see John Carswell, *The South Sea bubble* (1960); P.G.M Dickson, *The financial revolution in England: a study of the development of public credit, 1688-1756* (1967); H.J Paul, *The South Sea bubble: an economic history of its origins and consequences* (2010)
[6] 'The financial system: what went wrong' *The Economist*, March 19 2008 http://www.economist.com/node/10881318 *Accessed January 28th 2016*

past, and bring them a rich, commercial future'.[7] His only attention to geography is in romantic descriptions of Darien Isthmus as a 'central American swamp' with 'smooth shores of white sand, tiny island like green jewels'.[8] David Armitage identifies the interests of Company promoters, arguing that this was due to the region's potential to provide a commercialist path of political and national development, and to become an entrepôt that might 'control world trade' and 'hold the key to national regeneration' without the costs of standing armies.[9] These characterisations obscure a core reason for choosing Darien – its access to the Pacific Ocean. That Scottish merchants and political elites were keen to cash in on South Sea trade is clear in statements made by leading Company figures, and in colonists' focus on recording information about the proximity of the settlement to the South Sea. Rather than seeing the Darien venture as an irrational anomaly in Scottish political and economic history, the effort to establish a Caribbean colony in 1699 was in fact coherent with broader European interest in Pacific trade.

Likewise the importance of trade to the South Sea Company is underestimated by historians. John Carswell argues that Spanish American trade was peripheral, and Julian Hoppit claims that 'trade was always of minor importance to the company'.[10] This corresponds with earlier historiography that concluded that the actual amount of trade and resultant profit was very limited. Recently revisionist historians such as Helen Paul have instead concluded that Company interest in trading to Spanish America was serious.[11] This corresponds with efforts to write a less Anglo-centric history of the Company and in a recent monograph about Irish investors, Patrick Walsh notes that the company's outlook was in fact 'global'.[12] Shinsuke Satsuma and William T. Morgan acknowledge the alignment of the Company's trading objectives with British imperial aims in their discussions of a proposed military campaign to the Pacific in 1712 and an expedition to French Canada in May 1711. But although they identify the longer reach of imperial ambitions in the Company's activities, the authors do not analyse links with the previous 40 years of Pacific exploration.[13] Information collected on John Narborough's expedition, the buccaneer voyages and in the Darien voyage had helped to demonstrate of the viability of trade, whilst the interest generated by these voyages created a scenario in which the Company envisaged viable and productive trade in Spanish America. The Companies were acutely aware of the importance of geography, an aspect that historians have neglected, as highlighted by details of the voyage preparations in Scotland, documented in company account books and captain's invoices.[14] Similarly, South Sea Company use of eyewitness knowledge from buccaneers, as well as collection of manuscript information,

[7] John Prebble, *The Darien disaster* (Edinburgh, 1978), p. 29
[8] David Armitage, 'The Scottish vision of empire: intellectual origins of the Darien venture' in John Robertson ed., *A union for empire* p98; Prebble, *The Darien disaster* (Cambridge, 1995) p. 66
[9] Ibid, pp. 104-104, pp. 108-109
[10] Carswell, *South Sea bubble*; Julian Hoppit, 'The myths of the South Sea bubble', *Transactions of the Royal Historical Society* Vol.12 (2002), pp. 141-65, p. 142
[11] Paul, *South Sea Bubble*
[12] Patrick Walsh, *The South Sea Company bubble and Ireland: money, banking and investment, 1690-1721* (Woodridge, 2014) p. 2
[13] William T. Morgan, 'The South Sea Company and the Canadian expedition in the reign of Queen Anne' *The Hispanic American Historical Review,* 8:2 (1928), pp. 143-166; Shinsuke Satsuma, 'The South Sea Company and its plan for a naval expedition in 1712' *Historical Research* 85: 229 (2012)
[14] Accounts of captains, contractors of Company of Scotland MS83.6.3, MS83.5.9, MS83.5.8, MS83.72, National Library of Scotland, Edinburgh, UK

indicates investment in building geographical knowledge of the region. Furthermore the raw geographical information recorded by Darien colonists, including descriptions, drawings and maps made by Colonel Leven and Colin Campbell, highlight how companies could create additional information.

This chapter makes two key points. The first is that the interest of chartered companies in Spanish America was not incidental or simply an expression of imperial ambition, but instead they were explicit attempts to access Pacific trade and gain a foothold in Spanish America. Crucial to this ambition were the prior 40 years of exploration and collection of geographical knowledge, as described in chapters 3 and 4, which Company officials and politicians called upon when making decisions. They used information gathered by Narborough and privateers, and in some cases, asked buccaneers to offer expert advice. However, as will be seen, reliance on a small pool of experts had drawbacks due to the limited ways to corroborate their claims. The second theme concerns how Company interests generated useful knowledge. Information collected on the Darien expedition informed new geographies of the region, whilst South Sea Company demand for information stimulated the market for printed knowledge in London. The chapter analyses geographical information in account books, ship logs, inventories and manuscript diaries from the Darien Company that have been little used by historians. It also uses letters, book catalogues, and printed books and maps collected by the South Sea Company. Furthermore, the two companies have not been previously discussed together by historians as evidence of regional interest by English and Scottish merchants in Spanish America, and this approach takes analysis of their histories beyond national concerns to their global context. Although the South Sea Company traded until 1838, this chapter focuses on the years leading up the financial crash in 1720.

The Company of Scotland was a joint-stock venture established in 1693 by a group of Anglo-Scottish merchants challenging the East India Company monopoly.[15] Following threats of legal sanctions from the English Parliament, the company withdrew to Scotland in 1696 and opened up to subscriptions.[16] In June 1695 a Scottish Parliament act empowered the company to plant colonies with a monopoly for 31 years, and the Directors settled on Darien in Panama as the best location.[17] After landing at Darien in October 1698 colonists made a rudimentary settlement, but it soon became clear that short supplies, disease, and aggression from the Spanish and antipathy from the English would number the colony's days. A second convoy arrived to an abandoned settlement in June 1699, and following a counter-attack by Spanish, the Scots left for good in April 1700, with none of the four ships making it back to Scotland. The financial loss to Scotland was so great that some historians argue the country was forced to ask England for financial support, leading to agreement that it abdicate its political and economic independence to join with England in the 1707 Act of Union.

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[15] The following account of the Company's history uses T.M Devine, *Scotland's empire 1600-1815* (2003); G E Vaughan, *Story of the Scottish settlement in the Darien 1698-1700* (1962); Prebble, *The Darien Disaster* (1968); Ned C. Landsman ed., *Nation and Province in the First British Empire: Scotland and the Americas* (Lewisburg, Pa., 2001)

[16] Armitage, 'The Scottish vision of empire' p. 100

[17] W. Douglas Jones, '"The Bold Adventurers': A Quantitative Analysis of the Darien Subscription List' *Journal of Scottish Historical Studies*, 21: 1 pp. 22-42 (2001)

At the same time that England's domestic empire grew, the English government attempted to expand colonial trade by securing a contract or *asiento* with Spain to trade in enslaved people, which it was eventually granted in 1711.[18] Although the Royal African Company traded in enslaved people in West Africa, this was the first opportunity for England to trade directly with Spanish merchants. The *asiento* obliged England to deliver 4,800 *piezas de indias* or enslaved people annually to Spanish American colonies from 1st May 1713. Proceeds in bullion and local products could be transported duty free on English or Spanish ships, and company contractors were authorised to engage in limited commerce at fairs in Cartagena, Portobello and Verza Cruz.[19] It opened the door for England to expand trade into Spanish America, albeit on Spain's terms. The South Sea Company was established by Act of Parliament in May 1711.[20] It could issue stock and absorbed short-term public debt - about £9,000,000 - and after accepting the terms of the *asiento* in February 1714, it began trading. Although the actual volume and value of trade between 1714 and 1718 (war with Spain interrupted trade from 1718-20) was minimal, discussions of how to expand trade reveal the role of geographical knowledge in preparing the company to enter new markets.

Pacific trade

The directors of the Company of Scotland were clear from 1696 that the colony would be established at the Darien Isthmus in Panama. Some historians argue that selection of Darien can be traced to Company promoter William Paterson's life-long obsession with the region.[21] Paterson had lived in British North American and in Jamaica, and though he had never visited Spanish America, he collected maps and accounts about the region.[22] This focus on an individual's passion overlooks discussions of the strategic advantages of Darien's location between the Pacific and Atlantic oceans. Paterson himself justified the selection of Darien by virtue of access to the Pacific - he claimed 'the time and expense of navigation to China, Japan, the Spice Islands, and the far greatest part of the East Indies will be lessened more than half, and the consumption of European commodities and manufactories will be more than doubled'.[23] Another colonist described how 'we shall endeavour to procure a part in the South Sea, from whence it's not above six weeks sail to Japan and some parts of China […] by bringing the commodities of those countreys over this narrow Isthmus, the riches of those Kingsdoms may in four or five months time arrive in Europe'.[24] Darien was also attractive due to the gold mines in Panama

[18] Victoria Sorsby describes the history of the asiento. Victoria Sorsby, *British trade with Spanish America under the asiento* (Unpublished PhD thesis,1975) p. 8

[19] Profits were subjected to a duty of 33 1/3 pesos levied on each of the first 4,000 slaves with the remaining 800 duty free. One 300 tons ship could acquire cargo in the Canary Islands during the 30-year contract, and one ship annually could be trade with 500 tons merchandise for sale duty free at the fairs. Sorsby, *British trade* pp. 12-13

[20] The need to manage public debt and interest following the War of Spanish Succession, as well as Dessire by Tories to counter-balance the power of the whig-dominated East India Company are both considered crucial reasons for the creation of the company. Carswell, *South Sea bubble*; Dickson, *The Financial Revolution in England*

[21] Watt also writes, 'Paterson had been trying to sell his Darien 'project' for many years'. Watt, *The Price of Scotland,* pp.6-7. Prebble, *Darien Disaster*

[22] G. E Vaughan, *The story of the Scottish settlement in the Darien (1698-1700) and its importance in British history* (1962), p. 10

[23] William Paterson, *A proposal to plant a colony in Darien to protect the Indians against Spain, and to open the trade of South America to all nations* (1701)

[24] *The history of Caledonia, or, the Scots colony in Darien in the west, by a gentleman lately arriv'd* (Edinburgh, 1669) p. 32

as well as access to commodity markets on the Spanish American coast where European manufactures could be traded for silver. One colonist wrote that the company intended to 'establish a free and staple-port in some convenient Place or Places on that Isthmus or Nick of Land'.[25] A linked reason was the desire to trump growing French trading superiority. One pamphlet (1698) argued that the threat of French dominance of the region justified the Company's selection of Darien - 'the French had a Design upon all that Coast, or at least to make a settlement some where thereabouts; […] how that the firm settlement some where thereabouts, might be a means of preventing […] the Settlement of any powerful Forreign neighbour in, upon, or near any part of that Coast'. Finally, the strength of the Spanish response to the Scottish incursion at the heart of their empire indicates the high strategic importance of Darien, and that the Scots mounted a serious geo-political challenge, if not one that was likely to be successful due to the imbalance of military strength and resources.[26] This assessment highlights that rather than a foolhardy fantasy in the mind of Paterson, the Darien project was situated in a broader context of forty years of growing geo-political interest by European merchants and political elites in exploiting the potential of South America and Pacific trade, and by Scotland's observation of the rewards reaped by England from its imperial investments.

Trade was also important to the growth of the South Sea Company, as indicated in contemporary pamphlets.[27] Merchant Robert Allen published a detailed description of the structure of Spanish American trade, explaining where goods were sold and the Galleons' routes.[28] Allen described the ease at which goods were moved within the empire, describing silver and emerald mines in New Granada, and the trade fairs at Cartagena.[29] He argued that the time was ripe to enter the trade because Spain had fallen to 'pride and sloth'.[30] He also wanted to counter French success, writing 'that the French by carrying on a trade to the South-Sea, and selling their goods at easier rates to the Spaniards of Peru at their own doors, than the South-Sea galleonists can afford them at, have quite alter'd the Channel of that Trade'.[31] Ultimately, Allen urged 'whether it be possible to contend with the French, or recover the very great share and interest we used to have in that Trade by way of Old-Spain or Jamaica any other way, than by commencing and vigorously prosecuting a Trade to the South Seas'.[32]

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[25]Andrew Fletcher, *A short and impartial view of the manner and occasion of the Scots colony's coming away from Darien in a letter to a person of quality* (Edinburgh, 1699)

[26] Christopher Storrs, 'Disaster at Darien (1698-1700)? The persistence of Spanish imperial power on the eve of the demise of the Spanish Hapsburgs' *European History Quarterly* 29:1(1999), pp. 6-7

[27] Pamphlets also circulated that claimed the new trade ambitions would be a failure, mostly written by stakeholders in the Jamaica trade who stood to lose financially from a threat to their monopoly on slave trade to the Spanish

[28] For information about the life of Robert Allen see J.D Alsop, 'A Darien epilogue: Robert Allen in Spanish America, 1698-1707', *Americas* (1986), pp. 197-201

[29] Ibid, p. 11

[30] Paul W. Mapp discusses how French trade piqued British interest in the Pacific. Paul W. Mapp, *The elusive west and the contest for empire, 1713-1763* (Chapel Hill, NC. 2011), pp. 122-140

[31] Robert Allen, *An essay on the nature and methods of carrying a trade to the South-Sea* (1712), p. 32

[32] Ibid, p. 34

A letter to Parliament published in May 1711 also supported the proposed trade.[33] It commented that trade would support the British economy by providing employment and raising revenue, and it criticised French attempts to create a monopoly, writing that France 'assumes to it self the whole Treasure of America, the fatal consequences of which are obvious to every man'.[34] In 1711 Company propagandist Daniel Defoe argued that the first advantage of establishing a company was that it would 'open such a vein of riches, will return such wealth, as, in few years, will make us more than sufficient amends for the vast expenses we have been at since the Revolution'.[35] He listed the benefits that France were reaping from trade in Spanish America, saying that 'if not prevented, will only repair all her former losses, but enable her to arrive at Universal Empire in Europe'.[36] Spanish America market could also provide a market for goods produced in North America. Defoe argued that the trade would stimulate British industry — including demand for manufactures, increase employment, increase land value, and would build up the merchant navy.[37] His responsibilities as a propagandist mean that he probably over-stated the case, but his focus on Pacific trade and beating French advantage suggest there was popular traction in these appeals.

The supply of information about Spanish America to England since the 1670s contributed to the ideological investment of company directors in Pacific trade. Both companies consulted manuscript books and accounts of the region collected by experts. In September 1696 members of the Company of Scotland Committee of Foreign Trade were presented by Paterson with 'several manuscripts-books Journals Reckonings exact illuminated maps and others papers of discovery in Africa and the East and West Indies'.[38] These probably constituted printed accounts and maps, as well as manuscript accounts like those described above. A manuscript copy of buccaneer Lionel Wafer's journal of his travels across the Darien Isthmus was among these geographical papers and in the collection of a company subscriber Andrew Fletcher.[39] The company also directly solicited the testimony of buccaneers concerning the strategic importance of Darien. William Dampier and Lionel Wafer reported that with 500 men and the co-operation of the indigenous people it would be easy to settle Darien.[40] This turned out to be far from the case — Tom Devine argues that the apparent ease with which Morgan and others attacked Spanish settlements led Patterson and others in the company to believe that Spanish America was a 'paper tiger'. In reality there was little way for Directors to assess the veracity of buccaneers' claims due to the limited supply of eyewitness knowledge.[41]

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[33] *A letter to a member of parliament on the settling a trade to the South-Sea of America* (1711)
[34] Ibid, p. 9
[35] Ibid, p. 19
[36] Daniel Defoe, *A true account of the design and advantages of the South-Sea trade* (1711); Daniel Defoe, *Defoe's review: reproduced from the original editions, with an introduction and bibliographical notes by Arthur Wellesley Secord* (New York, 1938), viii. 178-9, no.44; viii. 181, no.45, p. 6
[37] Ibid, p. 20
[38] 'Abstract of the Proceedings of the Court of Directors of Company of Scotland trading to Africa and the Indies' in George Pratt Insh ed., *Papers relating to the ships and voyages of the Company of Scotland trading to Africa and the Indies, 1696-1707* (Edinburgh) 1924, pp. 11-12
[39] Walter Herries, *A defence of the Scots abdicating Darien* (1700); *Enquiry into the causes of the miscarriage of the Scots colony at Darien* (Glasgow, 1700), p. 97. MS Saltoun 17863, f. 18, National Library of Scotland
[40] Journal of Council of Trade, July 2 1697, National Library of Scotland
[41] Devine, *Scotland's empire,* p. 46

The South Sea Company also sought information about trade routes and potential settlement locations directly from people with experience of the region, as none of the Directors had eyewitness experience of Spanish America. Robert Harley collected manuscript accounts of Spanish American geography, including an account of the Darien voyage.[42] He owned a description and map of Havana port by Christian Lilly, royal surveyor in Jamaica, describing how easy it would be for an English fleet to attack the port.[43] Negotiations for the *asiento* involved requests by British for the right to occupy and fortify four Spanish ports, with a focus on the Chilean coast.[44] They consulted Woodes Rogers, a privateer who sailed to the South Seas in 1708, who advised that a settlement on the Pacific coast was essential if the Company wanted to trade.[45] However there are signs that Rogers exaggerated the extent of his knowledge. His claim that Spanish settlers were more interested in trading with English than with French seems like convenient but false encouragement for English trade, whilst the aggressive response of Spanish to Scottish presence at Darien in 1696 indicates that the buccaneer claims that the Spanish were weak or ambivalent was misleading. It highlights further how chartered companies were forced to rely on the small pool of people that had actually visited the region and therefore there was also little opportunity for cross-checking information. Although the request to establish fortified ports was refused by the Spanish, the focus on the Chilean coast suggests that knowledge gathered in the decades of collection of geographical information was applied in decisions regarding expanding British access to Spanish America.

The Company also discussed whether to establish a settlement (as opposed to a trade outpost) in Spanish America and chose Valdivia after discussion of other possibilities using information from previous voyages.[46] In 1711 merchant Thomas Bowrey proposed that an outpost between Rio de Plata and Straits of Magellan was essential to support Pacific trade.[47] He described the geography and latitude, highlighting benefits of ports at Angeado Bay, and wrote that a 'rutter' indicated that there was a good harbour at Porto de los Leanos. He also described Dessire and St Julian, suggesting that Bowrey used Narborough's descriptions. He discounted settlements further north on the Pacific coast, writing 'from Arica to Copiapo in 26:45 is a mountaineous baren inhabited countrey Coquimbo lyes in 29:50 Valparaiso and Conception in 36:20. All these places are very plentifull of provisions and the Spaniards not very numerous'. However, Bowrey concluded that the available descriptions of the region were insufficient and 'imperfect', and that a further discovery voyage would be necessary.

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[42] These accounts are included in Robert Harley's papers in the BL. 'Some general methods Propos'd for the better success of her majesties forces in their future attempts in the West Indies' Lt Col Christian Lilly 1704; Add MS 70164, 'Capt Laysork proposing to the House of Commons for the privateers pardon' Laysork to Harley 10 November 1704; Add MS 70310, 'Some propositions relating to the fitting of ships for the South Sea' George Byng to Harley 20 July 1711; Add MS 70163 'From on board the Riseing Sun in Caledonia, December 25 1669'

[43] 'Some general methods propos'd' Add MS 70164

[44] Sorsby, *British Trade* p. 10

[45] Woodes Rogers, 'Acct how a trade be carried on to ye south sea', Add MS 28140 fo.30r-v British Library. Arne Bialuschewski argues that news that Woodes Rogers had captured a Spanish prize in South Sea and was returning to England played a part in building public and investors' confidence in the Company in 1711. Arne Bialuschewski, '*A true account of the design, and advantages of the South-Sea trade*: profits, propaganda, and the peace preliminaries of 1711' *Huntington Library Quarterly,* 73: 2 (2010), pp. 273-285

[46] Williams, *The great South Sea,* p. 172

[47] 'Proposall for takeing Baldivia in the South Seas by Thomas Bowrey' September 10th 1711, Add MS 28140 f. 32-34, BL

The physical position and structure of Valdivia was believed to make it ideal for settlement. Bowrey described the port as 'healthy countrey, and has beever, horses, goats, sheep, fish, fowl and some corn and wine'. He commented that it could be supplied with provisions from island Juan Fernandez, which was 3 or 4 days sailing from Valdivia, and he promoted the port's potential as a marketplace. However the main appeal was its physical structure - a 'good harbour for shipping which may be so fortified as to secure our own shipping from a much superior force of enemys'. Bowrey estimated that just 100 men would be needed to take and keep control of Valdivia due to its distance from from Lima through 'mountaineous barren uninhabited countrey'. Bowrey argued that through 'improvement of these islands and kind usage to the natives in a short time we may have sufficient provisions for all our occasions'.[48]

Edward Cooke, second captain on the *Dutchess* on a voyage in 1708-1711, also wrote an account of Valdivia, including a table of the latitude and longitude of 48 ports in Spanish America.[49] Although it was not written for the Company, they probably consulted its findings. Cooke commented that with 'sufficient force Baldivia may be taken from and garrisond so as to keep it' but suggested that Juan Fernandez was a useful alternative.[50] He described Juan Fernandez as 'about 4 leagues long and 3 broad and is distinct from the main near a 100 leagues[…] you may ride here in 20 fathom water within a quarter of a mile to the shore'. The information in the table covered Valdivia to Cape St Lucas north of Acapulco, and recorded the latitude at Valdivia as 40:00 S, and longitude at 77:00W. Port Valparaiso was recorded at 33:45S latitude, 75:00 W longitude. The precision of the information contrasted with the subjective analysis offered by Thomas Bowrey and other buccaneers and probably provided the company with a more granular understanding of Spanish American geography.

Following a series of setbacks, the Company began trading in 1714. The Directors were able to establish six factories in Spanish America - in Buenos Aires to supply slaves to Rio de la Plata, Chile and Potosi, and in Cartagena, Panama, Portobelo, Vera Cruz for the Mexican market, and in Havana and Santiago de Cuba. Company entrepôts were established in Jamaica and Barbados, which managed the trade to the factories.[51] Two company ships were sent - the *Bedford* arrived in Cartagena in early 1716, and the *Elizabeth* in Veracruz in November 1715. Their arrival indicates that the ships had some successful command of the geography and navigation conditions of these ports. An exact line of utility cannot be drawn between the South Sea Company activities and the testimonies provided by Rogers and Cooke or the maps and information supplied by John Narborough and the buccaneers and privateers operating in the South Seas between 1660s and 1714. However the likelihood is that this information was used by Company officials in making their decisions about where to

[48] A short-lived plan to launch a military expedition in the Pacific in 1712 further illustrates how company officials used previously collected information to inform decisions as well as exploited geographical information in their planning. Shinsuke Satsuma describes this incident in detail in Satsuma, 'The South Sea Company'

[49] 'An account of ye places which ye Duke and Duchess anchor'd at in ye south seas wrote by Edw.Cooke, Commander of ye Marquiss Prize', Add.MS 28140 fos. 29-30, BL

[50] Ibid.

[51] Sorsby, *British trade* p. 40. Sorsby also provides significant detail about the structures of the factories, salaries, and relations between Company officials and Spanish inhabitants at the factories.

trade, played a role in generating interest in the region as a potential for trade, and played a role in guiding mariner and company factors in their trading and navigation decisions in the execution of Company business.

Raw Information Collection

Geographical knowledge was also important in making voyage preparations. Historians often suggest that the Darien voyage was poorly prepared, but accounts suggest that Patterson devoted attention to recruiting experienced crew, suggesting that he was aware of the navigation difficulties of the route. In November 1696 Patterson found a good candidate for captain: 'I were yesternight with a Sea Captain his name is Pinkerton he is very much talked of in this place and has spent most of his time in the West Indies. We made him some general proposals which he received kindly'.[52] He praised Pinkerton's geographical expertise, writing that he believed 'there is none in this place understand better than he what belongs to an African or American trade'.[53] Haldane referred to the social capital gained by recruiting captains who were considered experienced – 'many in this place think better of us than they did before for it was one of the Grand Objections that we were not like to imploy men of experience and reputation and none can say but these men have both'.[54] Robert Drummond, captain of *Caledonia*, wrote in a letter to the directors that he had spent eight years in total sailing in 'America'.[55] The Darien ships also recruited experts whilst at sea, including a member of Bartholomew Sharpe's crew, pilot Robert Allison. Campbell explained that in order to guide the ships from St Thomas to Panama, 'our captain engaged one capt Alleston (of whom you may have read in Mr Ringrose's history part 4 page 2) to be our pilot (for his was the design of our coming here)'.[56] The desire to use local knowledge to navigate the ships is further testimony to the priviledged position of buccaneers to obtain and use geographical information.[57]

The companies also contributed to geographical knowledge of the region. Mariners Colin Campbell, Hugh Rose, Colonel Leven, as well as anonymous colonists recorded information about rivers, weather conditions and topography, revealing how company activities for profit aided collection of natural knowledge.[58] The detail of this information has been unexamined by historians of Darien except to write a narrative of colony's history.

Some accounts described the geography of the cross-Atlantic route. At St Thomas in the Virgin Islands, Campbell wrote, 'I saw several sorts of trees, and fruits very pleasing to the eye and trees, sowr sap, wild pine apples, Indian corn, sugar canes. This island is very mountainous and woody'.[59] As the ships approached

[52] William Paterson's letter book to the Company of Scotland, MS1914, National Library of Scotland
[53] Ibid, f. 13
[54] Ibid
[55] Andrew Fletcher, *A short and impartial view of the manner and occasion of the Scots colony's coming away from Darien in a letter to a person of quality* (Edinburgh, 1699), p. 20
[56] Ibid.
[57] Watt, *Price of Scotland,* p. 146
[58] Colin Campbell Journal, MS.846 National Library of Scotland (NLS), Edinburgh
[59] Ibid

Panama, Campbell recorded weather, topographical and oceanic conditions, including latitude. He used subjective descriptions such as 'we saw land, extraordinary high and as we came nearer the water changed its colour yellowish, ye afternoon was calm', as well as precise measurements such as 'we perceived a great current which drove to ye eastward. Obs 9d 40nM'.

Useful information was also recorded about Darien coastal geography. Campbell highlighted the difficulty of accessing the coast by describing how attempts to sail into the bay were thwarted by wind and a strong current: 'we found ourselves still driving to leeward by ye force of ye current against us, which made us set out to sea again. Obs was 9d, 14N'. These conditions continued: 'notwithstanding of our tacking to & fro of the current stil driving us to leeward made us anchor in ten fathom water at great distance from land'. Hugh Rose described how one ship ran a ground after hitting a sand bank that, despite taking water depth measurement, the mariners had not noticed, highlighting how precision measurement could not guarantee a ship's safety. This information about the maritime risks of accessing Darien was useful for strategic assessment of the economic advantages or disadvantages of trading to the port as well as the risk of shipwreck. Campbell also described whether food and water could be found in the area - 'aferward we sent ashore to see for fresh water, but found none, when they returned they brought a Guano, a pelican, and 100 babies'. He calculated water depth and wind direction - 'At break of day we found ourselves not 2 leagues distant from land where we cast anchor in 32 fathom water, about 6 leagues to the leeward of Golden Island and about 8 we weighed after it we found the wind and current contrary to us which made us drop it again'. He wrote the following day that there was 'little wind, but at 4 oclock afternoon we got pretty near Golden Island and dropt anchor in 25 fathom water'.

When the voyage began, colonists were told to 'with all possible speed dispatch home to us an exact journal of your voyage, landing and proceedings and condition of the place'.[60] Colonel Level and others obediently recorded observations in papers that are now in the National Library of Scotland. They assessed of the utility of Darien for settlement and trade. Leven described Darien as 'about 60 leagues in length, it ends about 16 or 20 Leagues up the Great River and is there seperated by a river called Key-Cruka that is on the West of the Great River and empties itself into it and the country of the Dariens ends about the middle of the Lamballo's'. He also drew a chart 'Caledonia Bay', with a crude outline of the bay, six islands at the northern entrance and one unnamed river in the north.[61] Marks indicated where it was possible for ships to anchor and six locations - Point Lookout, Forth Point, Medler Point, Watering Bay, Pinck Point, and Carret Bay - were drawn. However beyond this, navigation content such as water depths and shoals, was absent, suggesting that Leven was not able to record a full geography of the bay.

[60] Instructions to the Council of the Colony, ADV.MSS 83.6.2
[61] Colonel Leven account, ADV.MSS 83.7.3, f.55, NLS, Edinburgh

Hugh Rose provided more detail, writing 'at 6 last night the island Ferta bore E1/2S distant two leagues. This is a low island about a mile long, full of trees, which may be seen 7 leagues; there is good anchoring on the South side and very good weather'.[62] Hugh Mackenzie described the bay as 'very commodious […] capable of containing a great many good ships, naturally defended from winds or storms'. He calculated the width of the mouth as under one mile and used comparisons with British geography to contextualise descriptions:

> between the two opposit points, and even that indifferently well bomb'd over with a ridge of sunken rocks. The entrance and main body of the harbour ly towards the sea North North West, and towards the land South South West. It is in 9 degrees of North latitude, and about some 70d of meridian distance from St Kilda upon the coast of Scotland.[63]

Authors also provided information about inland geography. Rose wrote, 'we went in Boats to Casset Bay, which is about 2 leagues to the westward of the place where wee anchored last in, to view the bay and endeavour to get intelligence of Golden Island, wee being at a loss for none of us knew the land. Here wee met our friends that were board, who informed that Golden Island was some few leagues to the westward'.[64] Mackenzie described the best location for the settlement, 'they agreed upon about a league distance from Golden Island in ye afternoon having a sea breeze'. Rose described finding and measuring a harbour:

> we weighed and sounded all along the coast, and found a most excellent harbour about 4 leagues to the westward of where they lay all night, capable of containing 10,000 set of sails. It is made by an elbow of the main to the eastward, and a range of keys about it, 10 in number, running to the eastward above 2 leagues. To one of those called Laurence Key the greatest ship in England may lay her side to.[65]

Rose described how the new settlers tried to survey Golden Island:

> wee went in our boats to sound a bay about 4 miles to the eastward of Golden Island, and found it to be a most excellent harbour. The harbour is within a great bay, lying to the westward of it, made by Golden Island and a point of land bearing thence east about a league. From that eastmost point to the opposit one, is a random cannon shot, and in the middle of the entry lyes a rock about 3 foot above the water on which the sea beats furiously, when the wind is out and blowes hard.[66]

However, he reassured readers that the bay was navigable and provided lengthy detail about the breadth of the harbour (measured by 'cable-length'), variation of water depths, and the position of rocks. He wrote that the bay

> looks terrible to those who know not the place well, but in both sides the rock is a very good and wide channel, that to the southward being about 3 cable-lenth breadth, with 7 fathom water close to the rocks nose […] There is a small rock under water, a little within the points bearing off of the southernmost SSW and of the northernmost SSE and of the rock without SE and BE.

[62] Journal of Hugh Rose, ADV.MSS 83.7.4, f.12-14, NLS, Edinburgh
[63] Hugh Mackenzie to Mr Haldane on Board the Unicorn Caledonia Bay, Dec 21 1698, ADV.MSS 83.7.1
[64] Ibid
[65] Journal of Hugh Rose, f.13-14
[66] Ibid, f.13

Ultimately he argued that the harbour would be of great benefit for trade: 'this harbour is capable of containing 1000 of the best ships in the world, and with no great trouble wharfs may be run out to which ships of the greatest burthern may lay their sides and onload'.[67]

The geography of the river system was another key theme. One anonymous letter described six rivers and bays and assessed how easily they could be used for shipping or transport. Rivers that gave access to the Pacific from the Atlantic coast were rated more favourably. The letter described the river and gulf of Urbana as 'not yet well discovered, but what we know thereof is, that at its entrance and where broadest, it hath seven or eight leagues of breadth and hath four or five leagues in the narrowest place: It runs 25 or 30 fathom water. In its channel it hath many great Rivers run into it, of which three or four are said to be larger than the Thames'.[68] A river at the bottom of this gulf was described as 'commonly but eight or nine foot water upon these barrs, but there is 6,7,8 and 9 fathom water when with in and so for many leagues up: On the west of the gulf about fifteen leagues up, there is a river about two leagues broad'. However both rivers were described as blocked with fallen trees, which highlights the scope of work that would be required of colonists to use the rivers beyond firstly understanding their location.

Another river between Tubagantee into the gulf of Vallona was described as six leagues overland from Caledonia, but that from 'Stroatree to Tubagantee we have between two and three leagues not so passable by occasion of the windings and turnings of the River'. However, like in the Gulf of Urbana, the author argued that only if the river was cleared could it be used for trade. At what the author called Tubabantree, 'there is ten foot at high water, and so no less than in the River til it fall into the Gulf of Ballona which enters the South Sea. This Gulf of Ballona hath excellent harbours and roads for shipping'.

The author used precision measurements to describe a pass at River Cacarica as located at six degrees north latitude, and 8 or 9 leagues from Caledonia and 25 or 30 leagues from Gulf of Vallona. The account described a route from the river into the South Seas:

> they pass up a river on the right hand called Cacarica about six leagues and land at a place where there is a narrow neck of land not above two English miles broad of good passage way, after passing this neck of land, they come to the navigable part of a River running into the South Sea called Praya and from them they have 14 or 15 leagues into the South Sea.

River Conception was also claimed to have access to the Pacific via Chiapo:

> about 35 leagues in the westward of Caledonia harbour there is another from the River Conception in the North to that called Chipo in the South Sea, to goe by this pass it will cost four days of uneasie passage in small boats up to the River Chipo, and the passing down that River in small canoes will cost four days more so that there is no manner of comparison between this pass and the other two.

[67] Ibid, f.14
[68] Colonel Leven account, f.43

However, the author considered Tubantee to be superior for accessing the South Sea, writing that 'by reason of the want of a good harbour, the impoverishment of many flats in the River, and the great Rains that fall there abouts, the pass of Tubabantree seems far to exceed it'. Despite the advantages of these three rivers for accessing the Pacific, the author concluded that 'the most considerable for the sictuation, security and defence is your Port of Caledonia'.

Weather conditions in Darien were also documented, which helped to assess the number of months the port could open for trade. One author wrote 'the seasons […] are principally two, the one where of we call the dry seasons because in it there is not any rain but a continued course of brisk north-westerly and northerly winds'.[69] Leven also stated that goldmines at 'Cany' were five days travel and suggested that Scots could exploit the conflict between the indigenous groups and Spanish colonists to mine their own gold.[70] This indicates how economic priorities and the Dessire to exploit the resources of the region and its strategic position in relation to Spanish America and the Pacific Ocean determined the type of geographical and natural information that was recorded and communicated to Scotland.

They also made judgements about the colony's geographical accessibility. Leven had reservations about accessing the Pacific due to the difficulty of navigating the river Vallona - 'twelve hours travel to the South Sea but twas a lot to be there in the time of Rains, running so rampant that I could not get up the river'.[71] Leven attempted to sail in early November which is at the end of the wet season in Caribbean Panama and so it is probably that the river at Garachine was swollen with rain water.[72] Reverend Borland also reflected, 'the place of our harbour and fort here, was ill chosen and fixed upon, it being so difficult and dangerous getting out of it, for a great part of the year: besides it was near half a mile distant from good water'.[73]

Published accounts

Some of this raw information was published during or soon after the venture.[74] Some authors celebrated the collection of river and oceanic information as an indication of the colonists' diligence and a positive outcome of the voyage. One author, who claimed to be a colonist, described how 'as soon as they were arrived safe in the Bay […] they fell to sounding the Coasts, and found within a great Chain of Islands (among which the Golden Islands, by the Spaniards called St. Katherine), a most large and capacious Port, where ships of the greatest burthen may safely ride secure from wind and weather'.[75] The same text described the land: 'It's about

[69] Colonel Leven account, ff. 42-4
[70] Ibid, ff. 23
[71] Ibid, f.6
[72] Panama has a tropical savanna climate, with a dry period between January and April and wet season from May-December. Rainfall reaches 67 to 79 inches annually
[73] Reverend Francis Borland, *History of Darien,* (1700) p. 97
[74] Charles W.J. Withers discusses the role of geography and science, in particular chorography, in Scottish national identity in the late seventeenth and early eighteenth centuries. Although he focuses on the domestic work of Sir Robert Sibbald, Geographer Royal from 1682, the impact of exploring imperial Caribbean or Spanish America geography as another site of Scottish identity formation is an avenue of research that could usefully be explored. Charles W.J. Withers, 'Geography, science and national identity in early modern Britain: the case of Scotland and the work of Sir Robert Sibbald (1641-1722)' *Annals of Science,* 53 (1996) pp. 29-73
[75] *The History of Caledonia* (1699), p. 5

a hundred and twenty miles long and therefore broad. If it were possible to cut a Channel from sea to sea, capable of shipping, it would facilitate the Navigation of the world two parts in three'. It commented on the river system: 'the rivers that fall into the North Sea, because of their short course are not navigable'. It continued, '[…] with the various making of the shore, together with the Adjacent Islands, which are called Samballas, between which, and the continent, runs a Channel about a League over; which makes all along the Coast numberless safe Harbours, and supplies the defects of the rivers which are small'.

Prominent publishers also published information about Darien. Although these maps politically promoted Scottish successes, they also contained useful information. In 1699 Herman Moll published a map of Darien bay, including 9 depth marks, and rocks.[76] It distinguished between the 'outward bay and the 'inward bay', and on the eastern tip of the bay, marked 'Point Look Out'.[77] A description read:

> the Bay of Caledonia lies about 9 leagues West of the Gulf of Darien. We found the Ground near Golden Isles very foul and Rocky full of deep holes and uncertain soundings. But within the rock in the bay is very good anchor ground and here is plenty of Excelent good water. Ships may enter the Bay at either side of the Rock but the East side is the best.

Moll's decision to include this combination of information regarding access to the bay from the sea with detailed topography indicates both the supply of information following the expedition and demand for useful information.

Another map was published by Edinburgh printers John Vallange and James Wardlaw.[78] It was dedicated to the company Directors, and included an inset drawing of Caledonia harbour with 'New Edinburgh' marked and the note 'excellent harbour', with five depth marks in the bay, and houses with a Saltire flag asserting possession. A channel of over 20 miles was shown at River Darien, and a note marked the South Sea. Rivers Congo, Santa Maria, Cheapo and Conception were depicted in the same position and style as the maps published by Lionel Wafer, suggesting that the map designer took the information from the published accounts of the Dampier voyages. However the actual detail of geographical information on the main map was limited – with navigation information limited to the Pacific coast of Panama, in the form of a large sand bank drawn at Punta Mala in the north of the Bay of Panama.

The South Sea Company also acted as a source of demand for publication of public geographical information, but differed to earlier relationships of demand and supply for geographical information linked to English activities in the South Seas. Unlike the Darien venture, texts and maps were largely published *before* trade began in order to promote the Company. Information was based on synthesis of previously-published information, rather than claiming to be new knowledge returned from the Pacific. Publications often had strong political and propagandistic overtones, lauding the suitability of Pacific Spanish America for English trade.[79] In

[76] Herman Moll, *The Scots settlement in America called New Caledonia A.D 1699 Lat. 8.30 North, according to an original draught by H. Moll geographer*
[77] Ibid
[78] *A map of the Isthmus of Darien and Bay of Panama*
[79] See Arne Bialuschewski, '*A True Account of the Design'* pp. 273-285

1711 Herman Moll published a geographical account of areas that the South Sea Company claimed to have rights to trade in.[80] It was published shortly after Robert Harley's announcement of the company's formation to the House of Commons, indicating that Moll had recognised a political and financial opportunity to satisfy his patrons' agenda (he visited the same coffee house as Daniel Defoe who worked for Robert Harley).[81] He claimed that his account was more comprehensive than previous accounts, and he asserted its quality by claiming it was practical and accurate in contract to previous accounts which were 'historical and romantick'.[82] He claimed the account by Funnell, who sailed with William Dampier in his 1703-7 voyage, was based on an 'old Spanish draught', and that although it appeared 'regular' or accurate, 'it is not very certain'. Framing the quality in terms of accuracy of ports and harbours indicates the social capital in these attributes.

Moll also published a large map of the South Seas that included the Caribbean and stretche as far north as Florida and Mexico.[83] The title, 'A New & Exact Map of the Coast, Countries and Islands within the limits of the South Sea Company' asserted that the full Spanish American empire and Caribbean was under trading rights of the company. In addition to acting as a propaganda piece asserting British trading rights and intimate knowledge of the Spanish American empire, the map also displayed a significant amount of geographical and navigational detail. Insets of Valdivia harbour and the Isle of Chiloe showed water depths, the position of rocks and shoals, and complex constellations of islands and river inlets. Guayaquil bay showed 13 water depths spanning the width of the bay, and five large areas of shoals, as well as 16 river mouths, which Moll claimed were recordings made by Captain John Chipperton on William Dampier's 1703-07 voyage.[84] Moll also claimed to have used a Spanish manuscript to record that Isle St Clara was in Lat. 3:30 South and that the distance between Cape Blanco and Cape St Helena was 36 leagues. Eight insets showed significant trading places or outposts in Spanish America, including Acapulco, Gulf of Amapalla, the Gulf of Nicoya, the Gallapagos Islands, a Map of the Isthmus of Darien, Pepys Island, and a map of the Magellan Straits. Hutchinson argues that the public function of Moll's map was greater than the Hack's atlases described in previous chapters because it made public information from stolen Spanish charts rather than keeping it in manuscript.[85] Bialuschewski argues that 'publishers released or reprinted three different collections of travel accounts of South America, indicating that the establishment of the South Sea Company had already created increased interest in this little-known part of the globe'.[86]

In conclusion companies' demand for useful knowledge of the British empire, in particular of Spanish America where merchants aimed to establish new markets and colonies, promoted supply of printed

[80] Herman Moll, *A New & Exact Map of the Coast, Countries and Islands within ye limits of the South Sea Company* (London, 1711)
[81] Gillian Hutchinson, 'Herman Moll's view of the South Sea Company' *Journal for Maritime Research,* 6:1 (2004), pp. 87-112. John E. Crowley described Moll's social world in John E. Crowley, 'Herman Moll's the world described (1720): mapping Britain's global and imperial interests' *Imago Mundi*, 68:1 (2015), pp. 16-34
[82] Moll, *A View of the Coasts*
[83] Herman Moll, *A New & Exact Map* (1711)
[84] Hutchinson, 'Herman Moll's view', p. 104
[85] Ibid, p. 101
[86] Bialuschewski, '*A True Account*' p. 279

geographical information in London as well as created conditions for colonists and mariners to collect raw information. Geographical knowledge of the region and its proximity to the Pacific played a role in encouraging company officials to invest in trade to Spanish America. They used information gathered in the 40 years leading up to the first decade of the 18th century, including accounts by John Narborough and buccaneers, indicating the primary role of useful knowledge in informing geo-political and economic decisions. However although much of the information provided gave merchants a unique insight, not all of it was accurate and instead reflected buccaneer ambitions to promote themselves as experts. This highlights how the economy of geographical knowledge relied on a small number of eyewitnesses with disproportionate influence. This market played a direct role in encouraging and enabling British mercantile interests in the Spanish Pacific and in the Spanish American slave trade and continuing growth of English imperial prowess in the Atlantic world.

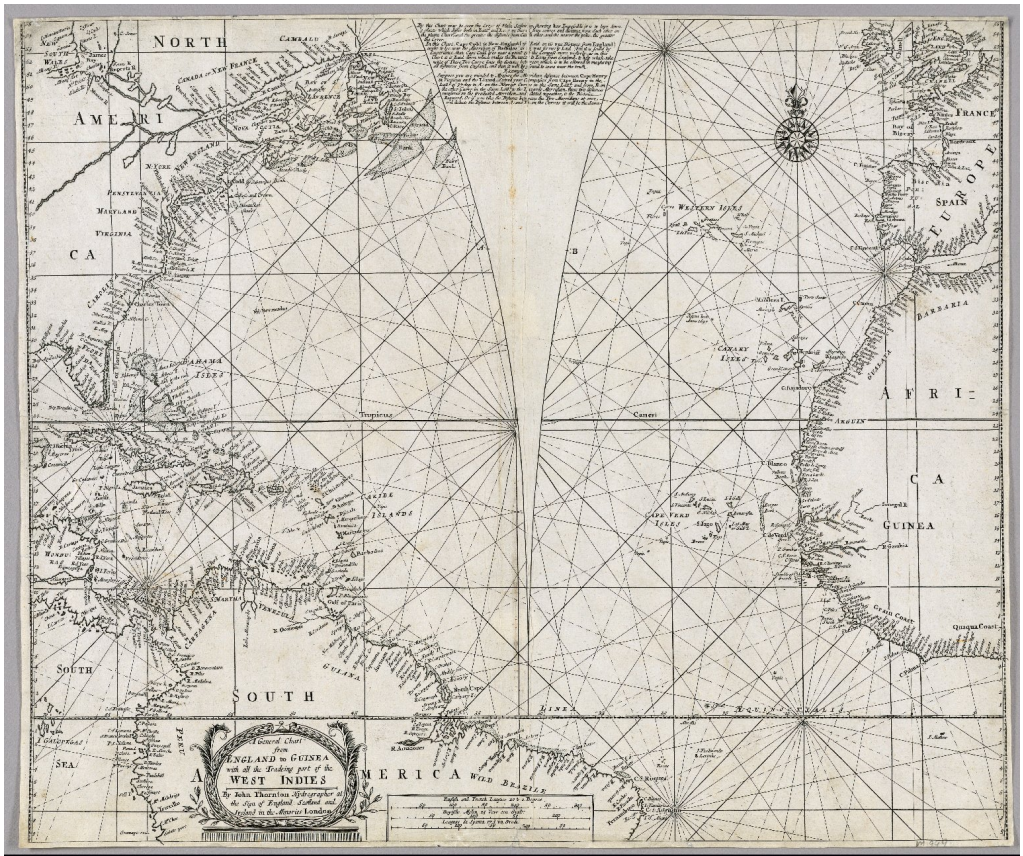
Chapter 6: Maps of the Americas and their makers

When the captain died on Nathaniel Uring's ship in 1701, the crew were around 40 leagues off the coast of Guinea and they decided to make landfall at *Rio Sistro* on what English traders called the Grain Coast (probably the Cestos river). 'We had no one with us which had ever been there, nor did we know any Part of the Land but as we judged by our Charts', wrote Uring.[1] The chart described may have been John Thornton's *A general chart from England to Guinea* (1672) which showed the coasts of Europe, West Africa and the Americas, and included navigation information like rhumb lines, river names and sand banks (see figure 1).[2] John Thornton was a promising publisher who published at least 28 charts and maps of the Americas during his career. Text on the chart explained the errors of plain sailing, thereby positioning the map and seller as knowledgable in navigation methods. The possible purchase and use of the chart on Uring's voyage, its role in guiding the mariners when they lost their navigation expert, and the chart's reflection of England's trading and maritime priorities reflect a map trade in London that was producing increasing amounts of geographical information in response to demand for knowledge from imperial expansion.

[1] Nathaniel Uring, *A history of the voyages and travels of Capt. Nathaniel Uring. With a new draught of the bay of Honduras* (1725), p. 31

[2] John Thornton, *A general chart from England to Guinea with all the tradeing parts of the West Indies* (1672). Small maps of Africa including Guinea were printed in texts by other English, French and Dutch publishers prior to 1701. A chart showing the West African coast was published by Robert Dudley in 1661 in Florence with less detail than Thornton's chart

Figure 25: John Thornton, *A general chart from England to Guinea* (1672)



Original in the John Carter Brown Library at Brown University

English map-makers had historically lagged behind their more skilled and more productive peers in mainland Europe.[3] Dutch maps in particular were considered to be the most sophisticated, beautiful and precise produced in the world.[4] In 1650, unlike their European rivals, English map-makers had not produced a national survey, a world atlas, or a sea atlas, and although there was discussion of the need to survey the nation's coastlines, this had not come to fruition. Peter Barber argues that 'by 1650, there was no English printed map trade to speak of and very little manuscript mapping being undertaken in the public sphere'.[5] London could

[3] R.V. Tooley, *Maps and map-makers* (1949), pp. 19-29; Robert Karrow, 'Centres of map publishing in Europe, 1472-1600' in David Woodward ed., *The history of cartography Vol 3: Cartography in the European Renaissance Part. 1* (Chicago, 2001), pp. 611-621; N. J. W Thrower ed., *The compleat plattmaker: essays on chart, map and globe-making in England in the 17th and 18th Centuries* (California, 1978)

[4] Cornelis Koeman, Günter Schilder, Marco van Egmond, and Peter van der Krogt, 'Commercial cartography and map production in the Low Countries, 1500-ca.1672' in Woodward ed., *The history of cartography Vol 3,* pp. 1296-1383

[5] Peter Barber, 'Mapmaking in England, ca. 1470-1650' in Woodward ed., *The history of cartography Vol 3.,* pp. 1589-1669. Barber documents growth in estate mapping and town mapping in England in the 16th century, but notes 'after 1612, however, the pace of British map production faltered […] the appearance of printed maps produced in England fell to a trickle.'

not boast to be home to dynastic publishing firms in the style of the Visschers or Sanssons that produced consistently highly-respected maps and charts, and England did not have prolific cartographers such as Mercator to boost the reputation of their trade.[6] This perception of inferiority and immaturity of English map-makers, and the prevalence of copying and plagiarism until the mid-18th century, is a dominant narrative in the historiography of early modern cartography. G.R. Crone argues that British cartographers 'followed, often with a considerable time lag, the practice of their contemporaries in Portugal, Italy, the Low Countries and France'.[7] Benjamin Schmidt writes, 'publishers outside the Netherlands crudely pirated, brazenly copied, or otherwise relied on Dutch originals to satisfy local demand'.[8] Historians tend to construct a hierarchy in the early modern map trade that was ordered by nation - a 'top three' countries approach. Dutch and Italian publishers dominated, followed by French, with other European countries straggling. Although the large number of prolific and expert Italian, Dutch and French publishers justifies scholarly attention, this approach overlooks the dynamics of demand for information according to geo-political change. It has obscured areas where publishers created geographical specialism, for example, English mapping of the Caribbean became more substantial than Dutch or French who, in the end, relied upon English maps.

However, historians Catherine Delano-Smith and Roger Kaiin have begun to challenge this interpretation, arguing that although Joseph Moxon's charts (1657) and Greenvile Collins coasting pilot (1690) were basic, 'John Seller was the first English printer to challenge successfully the Dutch monopoly of sea-chart production by adapting their charts for the English market.'[9] This discussion develops this argument, but instead of pitching English publishers against Dutch, it argues that a horizontal look at the trade using geographical expertise in map production, rather than total volume of production, reveals a more nuanced picture of the European map trade. Analysis of the volume of printed maps of the Americas published per European country suggests that the English map trade underwent a transformation in the second half of the 17th century. This significant rise suggests that English map makers had the capacity to outperform their Dutch and French rivals in select circumstances. It also puts map making in the context of geo-political developments, suggesting that trade responded to ongoing changes in the constitution of European empire.

Historians have also been skeptical of the capacity of English map makers for ingenuity and innovation. Claims by publishers to represent the 'latest observations and discoveries' on their maps are dismissed as little more than grossly-inflated boasting or even lies, and the contents of the maps are largely ignored as their similarity to Dutch or French maps is foregrounded. Concurrently historians have turned their eyes to the

[6] Koeman, Schilder, Egmond, der Krogt 'Commercial cartography', pp. 1296-1383
[7] G. R. Crone, *Maps and map-makers: an introduction to the history of cartography* (1953), p. 141
[8] Benjamin Schmidt, 'Mapping an empire: cartographic and colonial rivalry in seventeenth-century Dutch and English North America' *WMQ,* 54:3 (1997), pp. 549-578
[9] Catherine Delano-Smith and Roger J. P Klein, *English maps: a history* (1999), pp. 157-159

fantastical elements of early modern maps. Surekha Davies analyses the cultural history of depictions of indigenous peoples on Renaissance cartouches (up to 1645), while Chet Van Duzer focuses on drawings of sea monsters.[10] In a discussion of Dutch geography at the turn of the 18th century, Benjamin Schmidt considers a 'singular burst of printing, mapping, publishing […] images of the non-European world [that] sold an idea of the world that appealed to readers, viewers, and consumers across Europe through identifiably "exotic" features.'[11] Unfortunately, Schmidt gives no indication of the volume of production of these objects, and no sense of the market in which they produced. Whilst this work has highlighted how early modern cartography helped to construct visions of the 'new world' to observers at home, it over-represents the prominence of decoration at the expense of other more mundane but equally important information.[12] Figure 2 shows a breakdown of the type of cartouche drawn on English maps of the Americas.[13] It shows that although elaborate design continued to be used, simple cartouches or maps with no cartouche at all were predominant (57%). Sea monsters appeared on just two maps. However decorative maps did not disappear entirely, as indicated by John Seller's double-hemisphere world map (1672), which depicted the signs of the zodiac, sea monsters, angels and drawings of the Copernican, Tychian and Ptolomian planetary systems.[14]

[10] Surekha Davies, *Renaissance ethnography and the invention of the human: new worlds, maps and monsters* (Cambridge, 2016); Chet Van Duzer, *Sea monsters on medieval and renaissance maps* (2013)

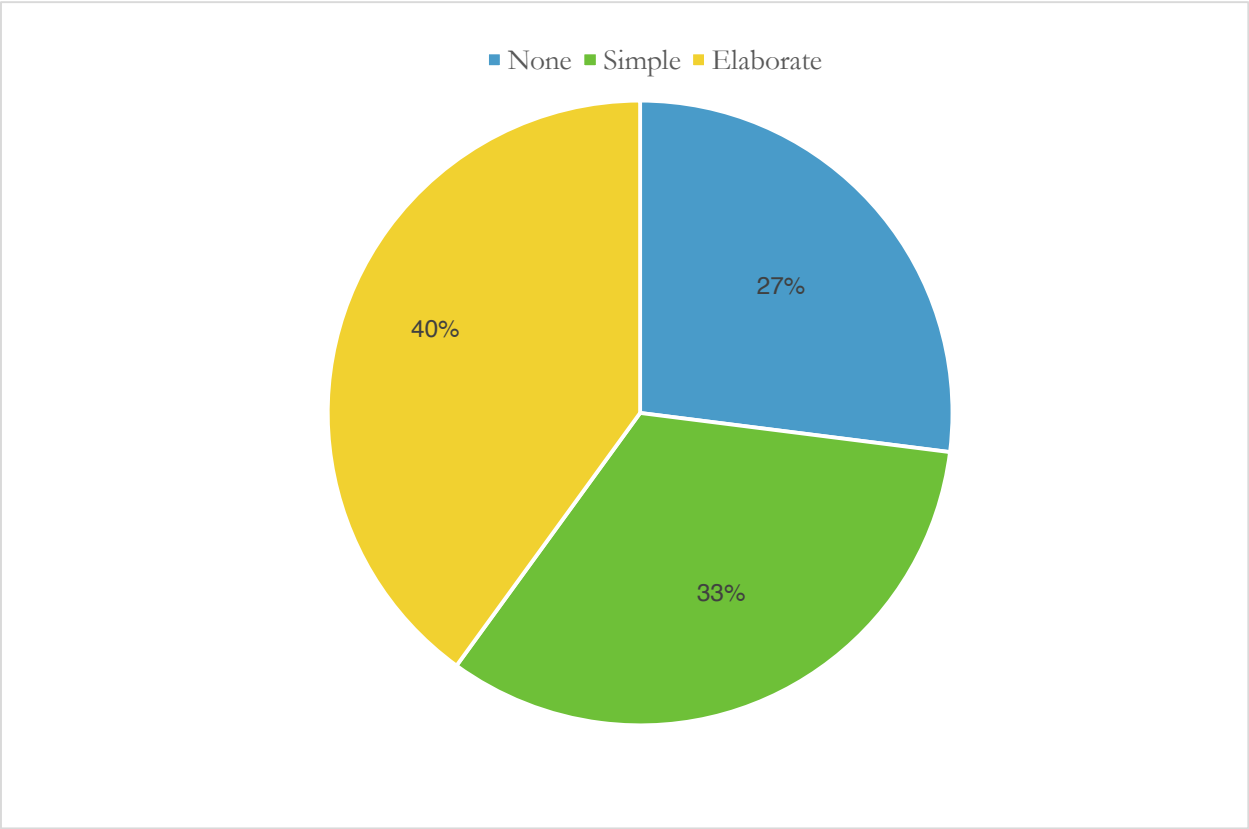
[11] Benjamin Schmidt, 'Inventing exoticism: the project of Dutch geography and the marketing of the world, circa 1700' in Paula Findlen ed., *Merchants and marvels: commerce, science and art in early modern Europe* (New York, 2002) pp. 347-369

[12] This is not to suggest that historians such as Surekha Davies have overplayed the case in analyzing constructions of indigeneity in early modern cartography - of course, the number of representations of indigenous people on cartouches does not arithmetically strengthen her argument - but that in focussing extensively on decoration, historians have underplayed the amount of 'useful' geographical and navigational information on the maps.

[13] By characterizing cartouches as simple, elaborate or non-existent, it is possible to consider what focus on decoration there was on the maps and charts. Simple cartouches can be considered as ones with minimal design such as flowers around the edge of a text box, and an elaborate cartouche was one with figures, animals, or graphically complicated design. Although this is a crude measurement, it gives an indication of what type of information was considered worth investing in

[14] John Seller, *Novissima totius terrarum orbis tabula* (1672)

Figure 26: Cartouche design on maps of the Americas 1660-1720



This chapter uses analysis of 179 English-made maps and charts of the Americas between 1660 and 1720 to answer the simple question - what did English-made maps of the Americas look like?[15] Maps varied in size, density of information, geographical coverage, and decoration, but they had two core themes.[16] Firstly they devoted significant space to useful information such as water depths, icons marking the location of rocks, symbols indicating safe anchorage, and rhumb lines to use in calculating a ships course for navigators to sail and navigate coastlines and harbours - in short information to get a ship to America. Secondly, they contained information that described landscapes with potential to be settled and the towns and plantations already settled - useful in informing invested colonial agents and in advertising the empire as open for business. Cartouches and insets showed flourishing industry and expanding towns in Newfoundland and the Caribbean. Utility and

[15] Although historians sometimes treat maps and charts as separate categories of cartographic material, there was no hard-and-fast distinction in this period. Many maps contained oceanic information and charts had topographical and decorative information - for that reason, this discussion does not analyse them separately

[16] Maps of the Americas appear to display an increased density of visual information during this period, including in information such as settlements, plantations, place names, rocks, water depths, and sand shoals. Put simply, by 1720, maps appear to include more graphic information in the same space as in 1660. Demonstrating this empirically using visual analytical software is beyond the scope of this thesis, but is a possible future avenue of research

function were also asserted by publishers. This geographical information projected an image of empire as productive, lucrative and 'up for grabs'. J.B Harley and historians who have applied his analysis argue that maps and charts were objects designed to transmit ideology and manipulate viewers into viewing geographical spaces in a subjective manner, according to a range of political interests.[17] This approach can be used to highlight how information on maps and charts of the Americas, such as images of cod production in Newfoundland, empty spaces on maps of Jamaica, and harbours displaying navigation information played a role in constructing legitimacy and advertising empire to consumers in London. Rhetorical appeals to accuracy and utility enhanced the reputation of the map and its maker, boosting its power as a tool of empire. However these ideological promotions of empire were packaged within maps responding to demand for useful information and displaying quotidian information, indicating that maps were not blunt tools of power and propaganda, but were produced to meet a variety of demands and interests. However, it should not be argued that decoration played a marginal role. Images depicting natural resources, trading industries, land free for settlement and convenient harbours promoted imperial expansion, and indicate that map-makers and publishers played a role in advertising and constructing British colonialism and its economic potential. This confirms map publishers' roles in the process identified by Eric Hinderaker: 'to construct an empire makes imaginative demands, and pays imaginative dividends, for the nation that undertakes it. Beginning in the second half of the 17th century, England was engaged in just such an undertaking'.[18] These decisions by commercially-sensitive publishers to make claims to sell apparently useful and practical information indicates that they were pitching to an audience that they believed wanted knowledge in order to expand empire, not (only) beautiful objects to hang on their walls.

The chapter then asks who made these maps? It puts the English map trade in the context of European trade, noting that Dutch, Italian and German publishers dominated trade in the 16th and early 17th centuries, but from the 1650s onwards, the volume of printed maps of the Americas printed in London overwhelmed the number of European publications. Analysis of maps of Jamaica highlight how the trade shifted according to global economic and political interests. The chapter discusses some key London map publishers, and uses fragmentary details from inventories to describe two map-seller's shops.[19] Ultimately the chapter demonstrates that demand for useful knowledge of empire boosted the supply of maps of the Americas and the English-made map trade, and publishers responded by including information useful for navigation, trade and settlement.

What did English-made maps of the Americas look like?

Commercial map publishers had many masters to satisfy. Maps were required to be (or look) geographically accurate and useful, to demonstrate English superiority and control over colonised or desired territory, and,

[17] J.B. Harley, ed., Paul Laxton, *The new nature of maps: essays in the history of cartography* (Baltimore, 2001); 'Maps, knowledge, and power' in eds., D. Cosgrove, S. Daniels, *The iconography of landscape* (Cambridge, 1988) pp. 277-312; 'Deconstructing the map', *Cartographica* 26:2 (1989), pp. 1-20
[18] Eric Hinderaker, 'The "four Indian kings" and the imaginative construction of the first British Empire', *WMQ* 53: 3 (1996), pp. 487-526
[19] Thomas Jenner inventory 27th January 1674. PROB 4/1117, The National Archives, Kew, London. Philip Lea inventory CLA/002/02/01/2444, London Metropolitan Archive. Both were identified and described by Sarah Tyacke

often, to be easy on the consumer's eye. But the super-served master during this period was utility - indicated by devotion of space to information that was, or was claimed to be, useful and accurate for imperial expansion. Two maps produced 50 years apart indicate how useful information came to dominate maps and charts. In 1658 Robert Walton published *A New Plain and Exact Map of America* (figure 3).[20] It showed the full American continent, with the western coasts of Europe on the margins to indicate links between them. Around the border were 14 portraits - eight of people from indigenous groups - 'a Virginian', a 'Magellenic', a 'Brasilian' and others wearing headdresses and holding arrows – and conquistadores including Columbus and explorers Magellan and Cavendish. Ten images of Spanish American towns were interspersed with the portraits, showing harbours, fortresses and mines in Cartagena, Potosi, Cusco and Cartagena. Fourteen simple drawings on the body of the map included a flying fish, a sea monster, and a man in a canoe. One drawing of a boat carrying two fishermen was larger than the area depicting Cuba, Jamaica, Hispaniola. Fifty years later, in 1711 and 1726, Herman Moll published two maps covering the same region, effectively doubling the space devoted to geographical detail – *A New and Exact Map of the Coasts of South America* and *A New Map of the Dominions of the King of Great Britain* (Figures 4 and 5). Portraits were largely replaced with detailed insets of strategic harbours and a trade card showing ordinary items for sale by publisher George Willdey. Apart from three ships in the Gulf of Mexico, the oceans were filled with notes about the position of rivers and lakes or other topographical features. The 'unknowne land' label on Walton's map also was not present on Moll's maps, which suggests that rather than indicating the discovery of the Antarctic, the admission of ignorance was no longer a commercially sensible inclusion on a map. Comparison of the maps shows that decoration did not disappear fully in the name of increased utility, but the inclusion of in-depth drawings of harbours, comprehensive place labelling, and the larger surface area devoted to smaller regions suggest that displaying useful information was a more powerful commercial strategy by the 1710s than in mid-17th century.

[20] Robert Walton, *A new plain and exact map of America* (1658)

Figure 27: Robert Walton, *A new plain and exact map of America* (1658)

Figure 28: Herman Moll, *A new map of the dominions of the King of Great Britain* (1726)

Original in the John Carter Brown Library at Brown University

Figure 29: Herman Moll, *A new and exact map of the coasts of South America* (1711)

Publishers portrayed the Americas in a variety of geographical combinations. Some maps showed the whole continent, whilst others were devoted to a single harbour such as Philip Lea's *The harbour of Boston or Matachusets bay* (1696).[21] Figure 31 shows that 64 maps depicted the full American continent, often including Nova Scotia and South America with Atlantic and Pacific oceans. Maps of single colonies outnumbered continental maps - 111 maps of single colonies were published, including Jamaica, Barbados, New England, New Jersey, Carolinas, Pennsylvania and others. It also included Spanish colonies such as Panama or

[21] Philip Lea, *The harbour of Boston or Matachusets bay* (1696)

Hispaniola. Single colony maps were not smaller in size, suggesting that publishers perceived greater interest in maps showing close-up geographical information rather than giving general pictures. Moreover, figure 31 indicates that those colonies with greater economic value were the subject of a larger number of maps. 15 maps of Jamaica and 13 of Newfoundland were published – both areas of intense economic interest in sugar and in fishing – compared to Florida and Maryland which were each the subject of just one map.

Figure 30: Geographical coverage on maps of the Americas published in London 1660-1720

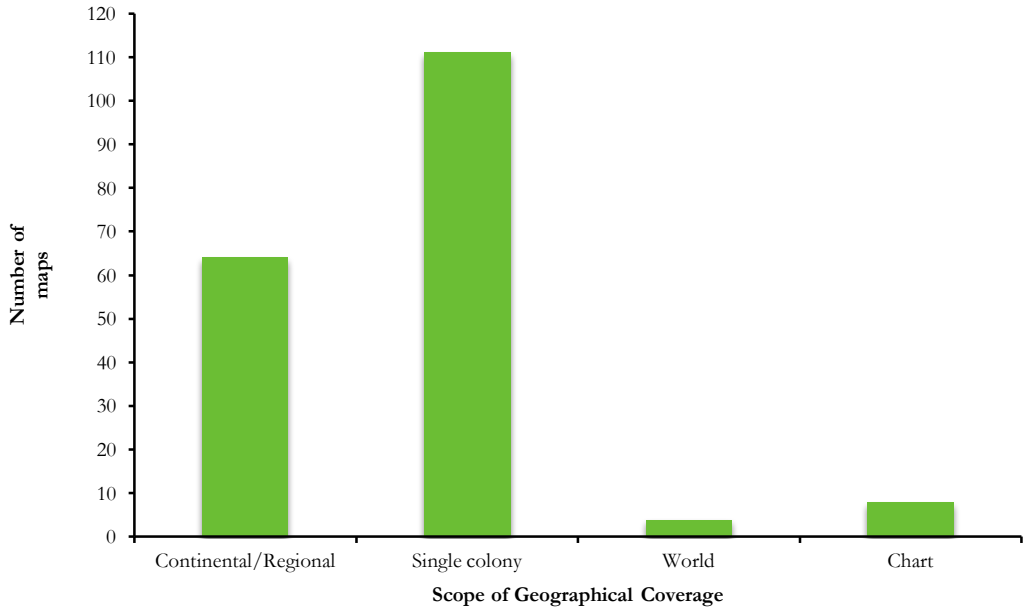
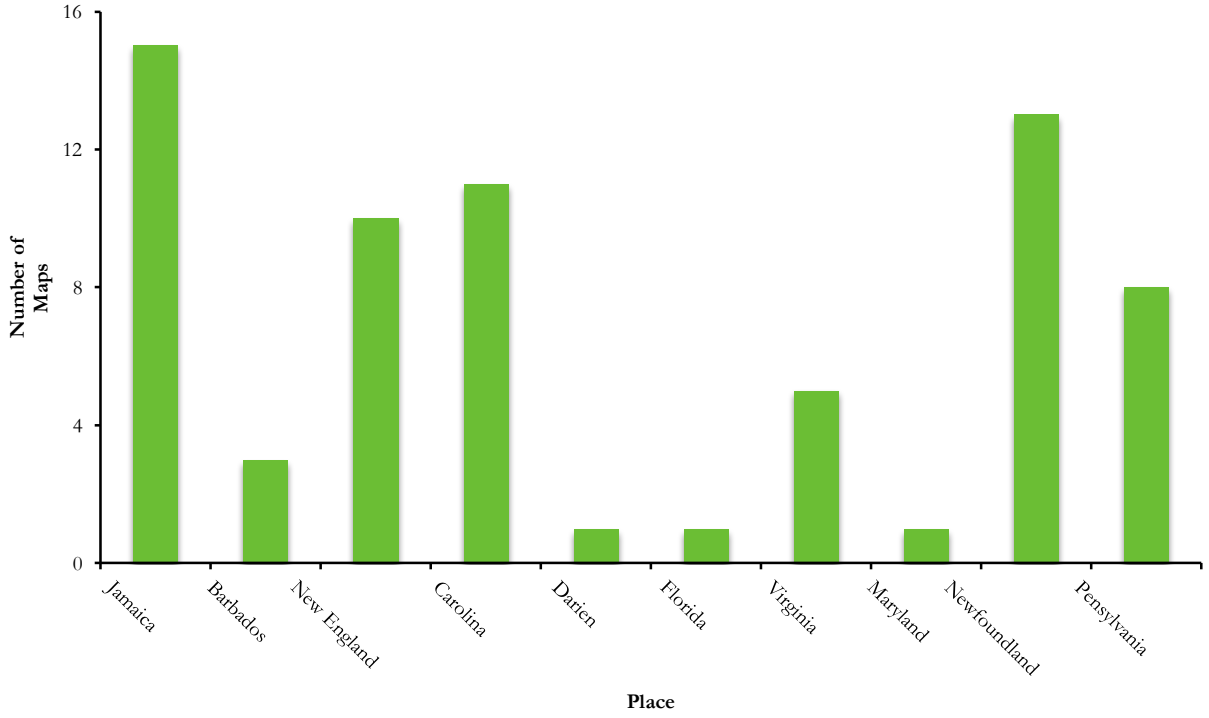


Figure 31: Single colony maps published in London 1660-1720



Maps and charts also included information that described the relative geography of empire - distances *in* the Americas not just in relation to Britain. This asserted their utility based on capacity to enable inter-regional activity, not only metropole-periphery interactions. Robert Morden and William Berry's *New map of the English plantations in America* (1673) claimed to show 'their true situation' and distances 'from the Lands End of England to Cape Cod is 2580; Bermudas 2760; Barbadoes 3430 English miles'.[22] Cape Cod, Bermudas and Barbados were important trade and navigation points, and publishing information about their relative distance may have been useful to support inter-regional trade.[23] John Seller's *A chart of the West Indias from Cape Code to River Oronoque* (1675) included information about the 'windward passage' between Cuba and Hispaniola. One chart of the Caribbean (1703) instructed the user in how to find distances between places, advising the use of a compass and ruler.[24] Herman Moll's map of North America gave an example of how to find distance: 'I desire to know the distance between New York and the Indian fort in Pensilvania; I extend the compasses from one Place to the other and applying that to the scale upon the parallel of 41, I find it is 128 miles'.[25] These instructions took the viewer through a sequence of explicit steps to reach a result that would aid the viewer in finding out

[22] Robert Morden and William Berry, *New map of the English plantations in America* (1673)
[23] Gregory O'Malley emphasises the importance of inter-colonial connections in the early expansion of the British Atlantic empire, particularly in the growth of the slave trade. Gregory O'Malley, *Final passages: the intercolonial slave trade of British America, 1619-1807* (Chapel Hill, 2014)
[24] Jeremiah Seller, Charles Price, *A new general chart for the West Indies of E Wrights projection* (1703)
[25] Herman Moll, Thomas Bowles, *A new map of the north parts of America claimed by French under ye names of Louisiana, Mississippi, Canada, and New France, with ye adjoining territories of England and Spain* (1720)

information to help navigation or geographical understanding. Similarly, Philip Lea accompanied a map of the continent (1687) with four indexes of place names and a grid for finding places on the map 'by which, with much ease and readiness may be found any Country, City, Town'.[26] It suggested that the user could look at the map to locate the exact position of any of the 883 places listed, both their position within the Atlantic system and relative to the geography of the Americas. This appears to have been the first visual attempt to codify the geography of the Americas for use by a consumer, and indicates that rather than just describe information to a passive consumer, some maps were constructed to generate useful geographical information in areas of high imperial significance. These maps turned themselves from an object to be viewed into one to be used to directly create further information.

Navigation Information

One of the two core themes in visual contents of maps and charts was the significant density of information devoted to aiding a ship navigate coastlines. Understanding coastlines was essential to navigation, to improving defence, and it was strategically important to geo-political claims of territorial sovereignty - demonstrating geographical knowledge of a coastline asserted that it was settled or at least partly controlled. Finally, coastlines were crucial to trade. Ports and harbours like Kingston, Bridgetown, Charlestown, and Boston were crucial nodes in the growing British trading network, and formed lynchpins holding the empire together. Knowledge of the position and the accessibility of these ports could help navigators plot a successful course and inform merchants about trade routes. Only one of the 179 maps and charts did not show coastlines. They showed islands in the Caribbean, settlements along coastlines in the North American colonies, or bay or delta entrances in the cases of the Chesapeake Bay, Newfoundland, and Delaware Bay.[27] Maps of North America and the individual colonies of New England, Virginia, Carolina, and New Jersey balanced depictions of the eastern seaboard with topographical information of the immediate interior, whilst maps of the Caribbean islands showed the full island coastline with increasingly detailed depictions of the interior over time. Robert Morden's *A map of ye English empire* showed the coast from Nova Scotia to the Chesapeake Bay, including the Long Island sound, Delaware Bay, bays 'Funda' and 'Chelanor' in Nova Scotia, harbours at Rhode Island, Boston and nine collections of sand banks. Some depictions of coastal geography responded directly to specific colonial campaigns. In 1670 privateer and Governor of Jamaica Henry Morgan raided Portobello, Panama. Three years later, a map of the Isthmus of Panama showed nine named coves or points and labelled the Straits of Darien and a settlement at Portobello.[28] The Isthmus was more finely detailed than on previous English maps, which

[26] Philip Lea, *An alphabet of America and the parts adjacent* (1687); Philip Lea, *A new mapp of America devided according to the best and latest observations and discoveries* (1687)
[27] Robert Green published a town plan of Philadelphia in 1683 which concentrated on the town, and had no coastal information. *A portraiture of the city of Philadelphia in the province of Pennslyvania in America by Thomas Holme Surveyor General.*
[28] Morden, Berry, *A new map of the English Plantations*

had shown Panama without bays, rivers or harbours. It also disguised the illegal nature of the raid by neutralising the venture: 'in December 1670 Panama was taken by the English and kept 28 days'.[29] The dominance of coastal geography was also probably the result of supply. Early settlement and exploration was concentrated along coastal areas, and therefore the collection of information and supply of geographical information to publishers was probably overwhelmingly about coastlines.

Coastal geography was one of the most dynamic elements in these maps. Sequential analysis of maps indicates that depictions of coastlines frequently changed, with addition or removal of details.[30] In analysis of 21 continental maps of North America, 9 showed changes in depictions of coastal geography compared to previous maps.[31] This was concentrated in the Long Island sound, Hudson's Bay, and the Chesapeake Bay, which were large and complicated bays that were instrumental in trade to tobacco and fishing trades. In some cases, coastal geography was the only aspect that changed. Joseph Moxon based *America Septentrionalis* (1664) on a map by French publisher Jan Jansson; however the Chesapeake Bay and Cape Cod were more detailed and had different shape, and following English seizure of New York from the Dutch in 1664, 'New Amsterdam' was replaced with 'New York'.[32] Similarly, in 1669 Richard Blome used a map published by French publisher Nicolas Sansson in 1650 to produce his own *A new map of America Septentrionalis.*[33] Much of the information matched Sansson's map, but in strategic area of Newfoundland, the coastlines were drawn differently. Newfoundland was commonly re-drawn on maps and charts, in response to the establishment of the Hudson's Bay Company in 1670 and the associated increase in maritime and trade activity. John Thornton published two maps of Newfoundland within four years of each other; *A New Mapp of the North Part of America from Hudsons Straights commonly called the Nor West Passage* in 1673 and *A Chart of the North Part of America* in 1677. Although the topographical outline of the land and the islands is the same on both maps, the second chart includes rhumb lines, and shows additional soundings in water around Terra Nova and the Great Banck, Nova Scotia, Cape Cod, in Buttons Bay, and in James's Bay.

Navigation information such as rhumb lines, soundings, position of rocks and location of harbours were also important components. Although these features were largely on charts, they were also included on maps. Seller explained the structure of a chart, writing 'on two of the sides of each Chart is a meridian line divided into degrees and minutes, for the findings of the latitude […] and on the surface the charts are drawn

[29] England and Spain had signed a peace treaty in 1671 but Morgan's raid and destruction of Portobello had challenged the amicability of this relationship

[30] None of the maps analysed were exact replicas of previously-published maps or charts. Although some featured very little change in detail, the change in design implied that a draftsman had worked on the design - this could be changed the nomenclature or altering a small geographical detail. In terms of labour, this has greater implication for plate production and engraving.

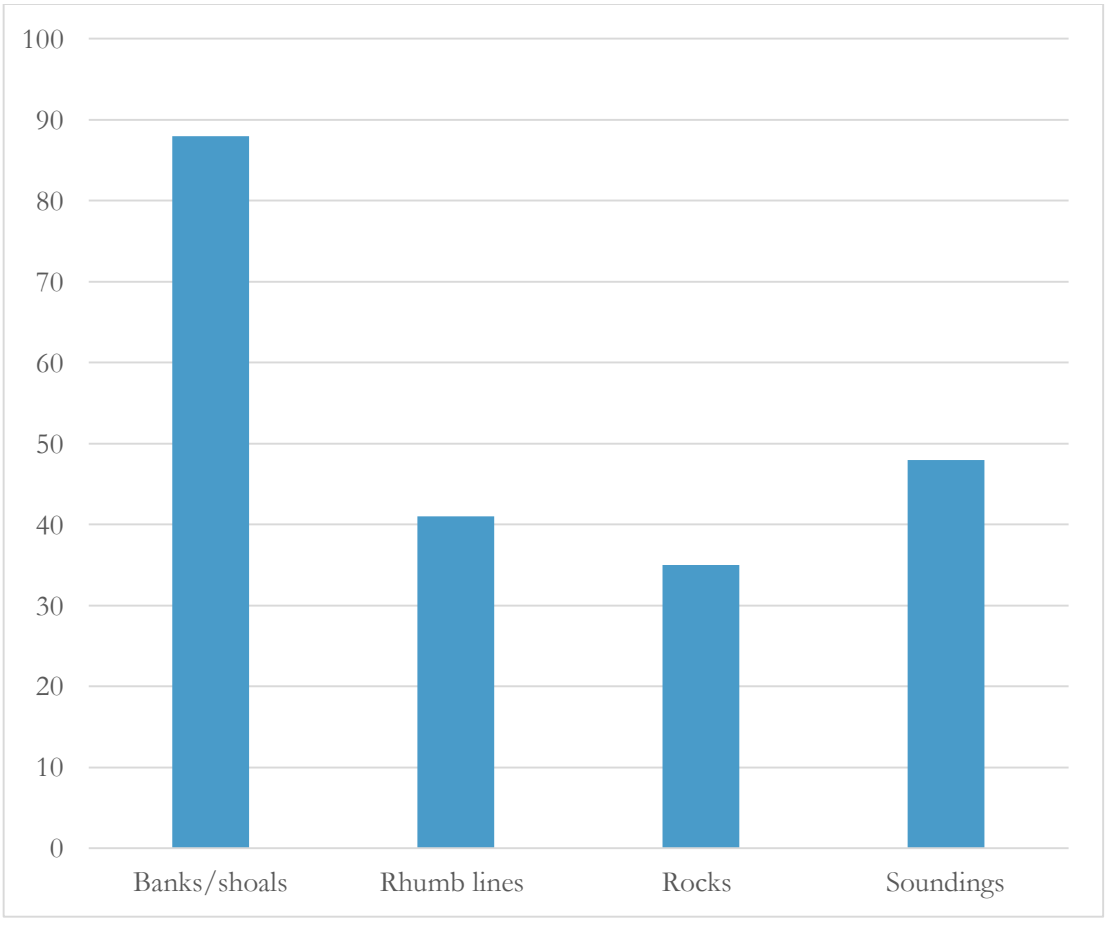
[31] This excludes maps of America printed in geographical books - these were usually illustrative and contained less detail, therefore did not include the most recent updates to design

[32] Joseph Moxon, *America Septentionalis* (1664); Jan Jansson, *America Septentionalis* (1652)

[33] Richard Blome, *A new map of America Septentrionale* (1669)

rhumb lines to find the bearings of one place to another'. John Seller's *Atlas Maritimus* included a guide in using charts, including how to find latitude on charts, the bearing between two places, and distance between two places.[34] These instructions imagine the challenges that atlas-users would face, and offers instrutions in exploiting the contents for navigation practice. Direct and step-by-step instructions in finding latitude were included - 'take your compasses and set one foot in the place required, and extend the other foot to the nearest distance of any East and West line, and note where that Line doth meet with the Meridian line'. Although Seller was probably including this information to boost his own authority as an expert publisher, the descriptions and instructions indicate the perceived importance of understanding navigation. Some publishers even pitched their charts as devoted to navigation information. Hans Sloane described a chart he drew of Jamaica in 1694 as simply, 'A Chart of Port Royal, ye keys, soundings, shoals'. Thomas Pound described one map (1694) by referring exclusively to its navigation information: a 'new map of New England from Cape Codd to Cape Sables describeing all the sands shoals rocks and difficulties together with a sand draft of the Mattathusetts Bay'.

Figure 32: Navigation information on maps of the Americas 1660-1720



[34] 'A short introduction to the understanding and use of the charts in this book' in *Atlas Maritimus* (1675)

Figure 32 shows the number of maps and charts that contained navigation information. 88 maps and charts had shoals or sand banks drawn. Assessing their position could enable a navigator to determine a safe course for the ship by charting a channel through shallow water to reach the coastline. The sand banks drawn varied in size and prominence - in the case of John Seller's *A Map of New Jarsey* (1675), clusters of banks were drawn along the length of the coast of New Jersey next to islands labelled 'some wood land and sandy riseings'.[35] In cases such as the Newfoundland banks, they were a key piece of information communicated on the map. In other cases, banks and shoals were more incidental, and spread along coastlines or islands. In Robert Morden's *Map of Ye English Empire* (1679), an inset of Boston harbour included detailed sand banks, as well as a line marking a 'shipp channel' leading up to Charles Town from 'maine' channel.[36]

48 maps depicted water depths along coastlines. Water depth measurements were used in conjunction with information about shoals to give further detail in safely navigating a coastline or harbour. Water depths could be depicted in clusters, usually in strategic areas, or dotted along a coastline. Soundings tended to range between 1 and 20, with fewer in deeper waters as the risk to ships decreased. The inset of Boston harbour in Robert Morden's *Map of Ye English Empire* included 50 soundings. Robert Morden's map of Darien (1699) noted 'between these islands & ye mainland there is very good ground where Ships may be careened and anchor safe at 6. 7. & 8. Fathom water'.[37] Henry Southwood's map of Newfoundland (1677) included many soundings on an inlet of St Johns harbour which was the largest settlement in Newfoundland and an important fishing port.[38] The soundings included up to a half point, which was an unusual level of precision for maps of his period. Herman Moll included instructions in using water depths in the Bay of Mexico on his map of the Caribbean (1709), which noted that in the Bay of Mexico 'you may know what distance you are from the shoar by Sounding the depth of water, and as many fathoms as you find, so many leagues you are from the shoar'.[39] Maps also alerted users to rocks, which posed an obvious threat to ships and could render a coastline or harbour too dangerous for sailing. Rocks were marked with an 'x', and often clustered together, but were sometimes sporadically spread across the map area. 35 maps included rock markings.

Depictions of Jamaica indicate the scope of navigation information on some maps. On John Ogilby's map of Jamaica, Port Morant was shown with three soundings and a small sand bank; Port Antonio on north coast shown with five soundings and small island with narrowing of the strait shown; Port Cagway shown with 12 soundings and a line of rocks; West Point Negrill shown with sand bank. John Ogilby described how to navigate four harbours in the island:

[35] John Seller, *A map of New Jarsey* (1672)
[36] Robert Morden, *A map of ye English Empire in ye continent of America viz Virginia, New York, Maryland, New Jersay, Carolina, New England* (1679)
[37] Robert Morden, *A draft of the Golden & adjecent Islands with part of ye Isthmus of Darien as it was taken by Captain Jenefer* (1699)
[38] Henry Southwood, *The coast of Newfoundland from Cape Raze to Cape St Francis described by Henry Southwood* (1677)
[39] Herman Moll, *A map of the West Indies or the islands of America in the North Sea* (1709)

> the chief harbors of this island are 1. *Port Anthony*, on the North, a very safe Land-lock'd harbor, onely the coming in is somewhat difficult, the Channel being narrow'd by a little island that lies off the Mouth of the Port. 2. On the east of the island is *Portmorant,* a very capacious harbor, where ships do conveniently wood and water, and ride safe from all winds. 3. On the South is *Port Cagway,* a Harbor wonderfully convenient, secure and capacious, being five Leagues over in some places, in others four, and at the narrowest, three; […] 4. On the West is *Point Negrill,* a Port very convenient and secure, to Wind-ward from which, a little North-West, is the Seat of the Old Town of *Melilla* founded by *Colombus* as afore mention'd[40]

Furthermore, when describing Barbados, Ogilby emphasised where ships could safely navigate and anchor: 'it is naturally fortified with rocks and shoals on the North and East side of it, where no ship may safely anchor […] on the south-east and westerly parts, it is all along a road where ships may Ride at anchor, but more especially in four chief places, Roads and Bays thereof'. He also described the main bays, including Carlisle Bay 'where five hundred ship of any burthen may ride safely from all but South and Westerly winds', and as well as describe three other bays, their proximity to towns, their exposure to winds and how commonly ships sailed there.[41]

Other navigation information included references to the first meridian on two maps, information about trade winds on four, and one described position as 70 degrees longitude from the Lizard. John Seller's *General Chart of the West Indies* (1676) was the first chart of America to use Mercator projection.[42] 42 out of the 179 maps and charts of the Americas were drawn to Mercator projection, 22 of which were published between 1680-1700. The remainder were either land maps and therefore were drawn with no projection, or used the more traditional plane projection. Some evidence suggests that use of the Mercator projection was associated with maps that emphasised novelty and utility.[43] In 1657 Joseph Moxon sold a *Plat of All the World* which he claimed was 'according to the truest rules being far more than a plain-card'.[44] He claimed it was 'newly corrected and inlarged', asserting the quality of the map through claims to be more comprehensive and geographically useful. He continued,

> this chart with equidistant and straight lined meridians, parallels and rhumbs, by reason of the continuing increase of the degrees of latitude in such proportion as the parallels in the globe decrease, from the equinoctial towards the poles showeth the longitudes, latitudes, courses and distance of all places, as truly, as the globe itself can doe.

Publishers also explicitly framed some maps as useful to mariners. John Seller dedicated his *Atlas Maritimus* (1675) to 'all merchants, owners, commanders and masters of ships, and all other officers and gentlemen concerned in maritime affairs'.[45] He asserted that the atlas would be 'useful for the merchant in this respect, That he may see in the Chart, (at any time), the Port or Place where his ship is, and may inform himself

[40] Ogilby, *America,* p. 343
[41] Ibid pp. 378-9
[42] John Seller, *General chart of the West Indies,* (1676); Burden, *Mapping of North America: Volume 2*, p. 105
[43] Further research would be required to determine a definite pattern
[44] Joseph Moxon, *Plat of all the world* (1657)
[45] Seller, *Atlas Maritimus*

of the commodiousness or danger of the harbor or place where she is, and what Wind will carry her into the Port, or bring Her out'. He claimed that the atlas contained useful information about sea-coasts, capes, headlands, soundings, shoals, rocks, as well as harbours, rivers and ports, with 'singular use' to mariners. Seller also claimed that in making the atlas he was,

> greatly obliged to several ingenious navigators for imparting their knowledge and experience of several places where they have been acquainted. And I hope it will be the continued practice of all industrious mariners […] as well as the public good and advantage of the nation in general.[46]

Settlement and plantations

The second core theme on maps and charts was the display of topography of the colonies, and the size and the location of settlements and plantations. This had three functions: firstly, to educate colonists about the geography of the colonies and settlements; secondly, to encourage further trade and exploitation by selling the potential of the empire; and finally, to put a firm stamp of possession on English colonies. This was achieved with a combination of geographic information and decoration. The use of pictorial detail to communicate messages about trade indicates that jettisoning the role of decoration in communicating useful information would be inappropriate. Decorative pictorial information, rather than geographic information, should not be considered antithetical to useful information like rocks or rhumb lines, and as will be seen, it played a role in promoting messages about the trade or settlement potential of a region.

Illustrating the position, length and connectivity of river systems was a priority. Rivers were essential to colonial development because they enabled an inland trade network for transporting goods from harbour to settlement and vice versa, and they facilitated further exploration of a colony. 90 of the 179 maps, or 50%, described river systems. Joel Gascoyne's map of Carolina included the title 'A perticular map for the going into Ashley and Cooper rivers', with soundings and sand banks marked.[47] A map of Philadelphia published by John Thornton (1683) included the River Delaware in a dedicated separate inset.[48] A map of Virginia and Maryland (1673) included the note 'the land between James River and Roanocke River is for the most parts low sunken swampy land not well passage but with great difficulty'.[49] Robert Morden and Thornton foregrounded the inclusion of rivers, creeks and bays in the title of their map of Carolina in 1695, 'This new map of the chief rivers, bayes, creeks, harbours and settlements in South Carolina actually surveyed'. A map of New Jersey published by John Reid in 1687 listed the rivers, 'A map of Rariton river, Milstone river South river/ Raway

[46] Seller, *Atlas Maritimus*
[47] Joel Gascoyne, *A new map of the country of Carolina with its rivers, harbors, plantations and other accommodations* (1683)
[48] John Thornton, *A portraiture of the city of Philadelphia in the province of Pennslyvania in America* (1683)
[49] John Seller, *Virginia and Maryland as it is planted and inhabited this present year 1670* (1673)

river bound brook/ Green brook & cedar brook/ with the plantations thereof/ also these on Chinquorora, Wickatonk/ the Heads of Hop River swiming/ River and Manasquam River likewise appeals some of Hackingsack River'. The inclusion of these details indicates the space and capital that publishers were willing to devote to information that could enable exploration and trade via water systems.

Maps also showcased and described early settlement by labelling places with English names, populating regions with houses, churches and towns, and legitimising settlers' claims to ownership by printing land owners' names. Robert Morden's *Map of New England* named 18 towns in Boston, and 14 around New York and Rhode Island, while his map of Virginia had 25 places named. Joel Gascoyne's map of Carolina (1682) claimed to show 'its rivers, harbors, plantations and other accommodations', and listed 33 settlements and owners in a note 'a table of the names of such settlements as are upon Ashley and Cooper rivers and other adjacent places'. Joseph Moxon advertised *The English empire in America* (1673) by listing its contents (seven colonies in North America and 15 islands in the Caribbean) and suggesting that it included 'pertinent' descriptions and information about 'the nature of the soil in each county; the product, commodities, and strength of each place; the policies, laws, customs, and manner of living'.[50] In this case, the map served not only as a geographical image, but was designed to teach the viewer about the natural resources, the economic potential, and the culture (laws and customs) of the English empire it depicted.

This type of topographical information increased in detail and density as the period progressed, as demonstrated by graphic representations of the geography of Jamaica. They showed the island turning from scarcely settled, with just 30 settlements and no interior topography, to an island with dense settlement in southern parishes, explored rivers and lucrative planted land. A map of Jamaica printed six years after English conquest, showed an island without mountains, rivers or settlements apart from a single church drawn at the Spanish capital St Jago de la Vega.[51] Coastal coves and rivers mouths were named, and the southern and north-eastern side had water depth marks. The first detailed map was published in 1671.[52] Coastal places were named and 11 of the 13 parishes had English names. The three most populated coastal parishes St Andrews, St Catherine and Clarendon were shown with significant density of settlement, plantation and rivers detail, but much of the body of the island was depicted as unsettled. This suggested to the viewer that Jamaica was relatively unpopulated, but crucially, not unexplored. Lauren Benton argues that in the early modern Atlantic 'mapping was another technique for demonstrating possession. Settlements, including forts, were equally important symbols, both demonstrating an intent to occupy and serving as evidence of actual possession. The Spanish considered towns as positive proof of civility'.[53] The presentation of Jamaica as explored, with the

[50] Moxon's *The English empire in America described in a map* was advertised in *Term Catalogues* Vol 1, June 16 1673
[51] Edmund Hickeringill, *Jamaica Viewed* (1671)
[52] John Ogilby, *Novissima et acuratissima Jamaicae descriptio per Johannem Ogilium,* (1671)
[53] Lauren Benton, *A search for sovereignty: law and geography in European empires, 1400-1900* (Cambridge, 2010) p. 56

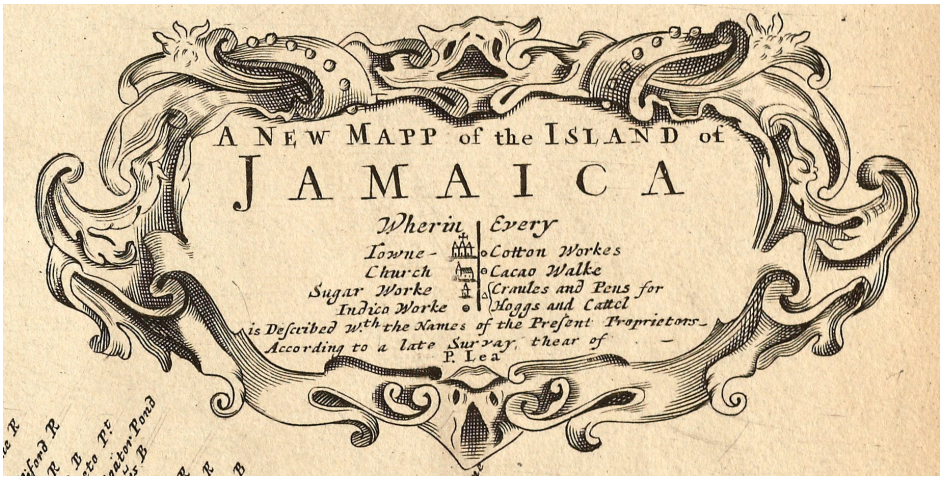
establishment of plantation crops, and bearing English place names put a stamp on the island as distinctly English to the viewer. This crucial assertion of sovereignty followed the signing of the Treaty of Madrid one year earlier which had given England control of territories in the Caribbean where they could demonstrate possession and indicates the role that colonial maps played in geo-politics.[54]

In 1684 a map published by Charles Harper added more detail to the picture of Jamaica.[55] He claimed that the map contained,

> the true and just sictuation of the severall townes & churches & alsoe the plantations, with their names and the names of the propietors with amendments of great part of the sea coast, but more especially the harbour of Port Royall, by actuall survey to satisfy such as Dessire to know the true longitude and latitude of any places mentioned in this Map, the latitude of Port Royall was accurately taken by a Gnoman of more than 23 foot high, and found to bee 17:32 and its longitude from London 76 westbound or 5 hours & 4 minutes.

In addition to providing latitude details of the island for the first time in a printed map, Harper kept his promise of fleshing out more detail of the island geography. The map marked more place names and parish boundaries, particularly in the southern developed parishes of St Andrew, St Catherine and the area surrounding Port Royal. Bays, rocks and depths were marked in Port Royal harbour, while St Davids in the east had significantly more topographical detail including place names and a small settlement by Salt Pond Point. The northern coast had many coastal places named marked and some settlements.

Figure 33: Title and key on Philip Lea *A generall map of the continent and islands which bee adjacent to Jamaica* (1685)



[54] Benjamin Schmidt discussed the use of maps by Dutch colonial officials to demonstrate possession in New Netherland in the early seventeenth century. Schmidt, 'Mapping an empire' pp. 549-578

[55] Charles Harper, *A new and exact map of the island of Jamaica*, (1684). Harper also claimed that the map was made using information collected by Bochart and Knollis, whose names are listed in maps made by surveyors of parishes in the National Archives in Jamaica

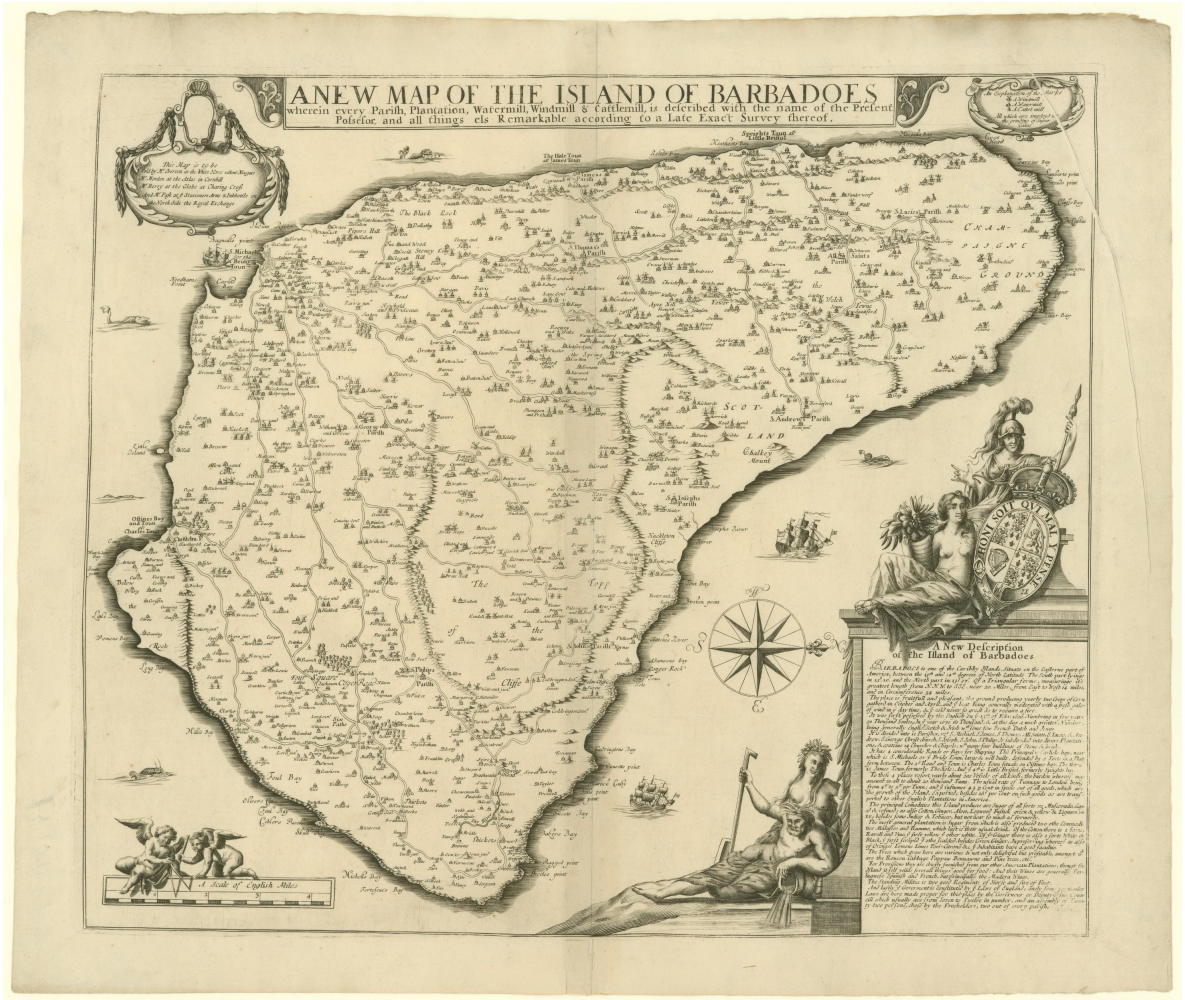
Some maps of Jamaica also included information that emphasised the development of plantations and commodity trade. In 1685 Philip Lea promised to describe 'every towne church sugar works indica worke cotton works cacao walke craules and pens for hoogs and cattel is described with the names of the present propietors' in a map of Jamaica (figure 33).[56] The map included dense detail and marks such as 'Modifords salt pond' close to Port Royal. Ogilby's map (1671) included a large table listing plantation by owner and type of crop and corresponded to symbols indicating their location (figure 34). The table occupied the bottom half of the map, and included over 100 plantations and indicates whether they were indigo, sugar, cotton, or cacao. Many of the names correlate with plantation owners, and they indicate to the viewer that a breadth of crops could be cultivated in Jamaica and that over 100 colonists were profiting from successfully established plantations. This further enhanced the impression that settlement was in full-swing but it also sent a message to potential colonists that profit was ripe for the taking. It indicated to people in England that, at a time of growing population and falling real wages, there was a new colony with thousands of acres of land available for settlement and cultivation that could emulate the sugar successes of nearby Barbados.[57]

Figure 34: Detail on John Ogilby, *Novissima et acuratissima descriptio Jamaicae* (1671)

[56] Philip Lea, *A generall map of the continent and islands which bee adjacent to Jamaica* (1685)

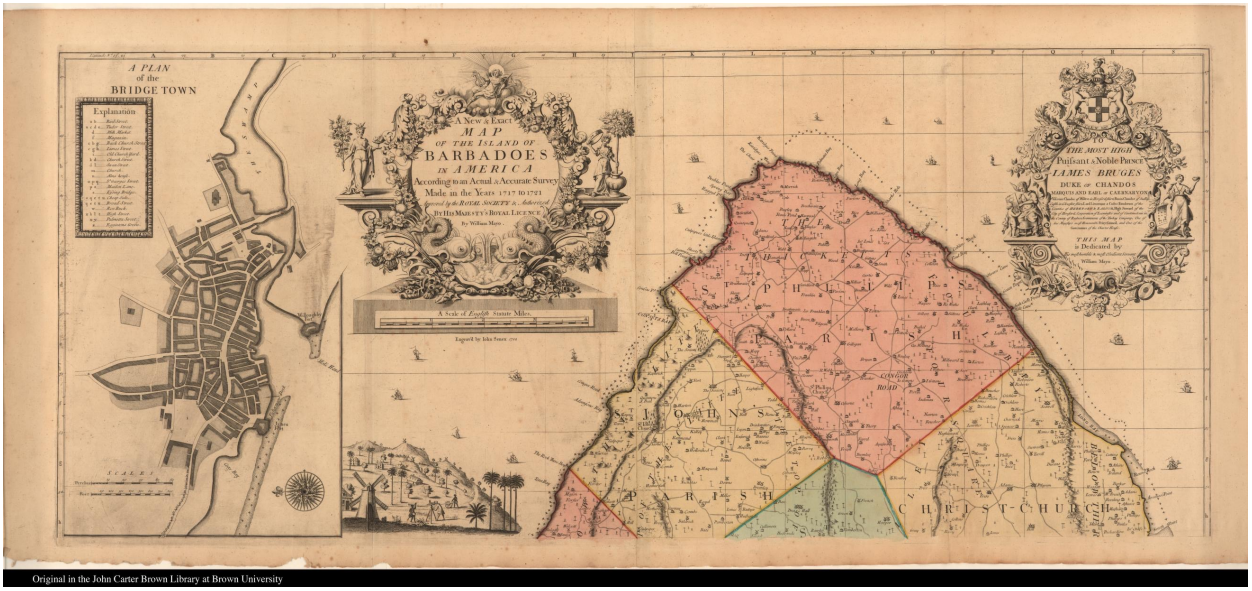
[57] Sugar production in Barbados had expanded significantly between 1646 and 1652. In 1668, the value of sugar imports to London from Barbados had reached £329,129.8. Nuala Zahedieh, 'London and the colonial consumer in the late seventeenth century', *Economic History Review,* XLVII, 2 (1994), pp. 239-261

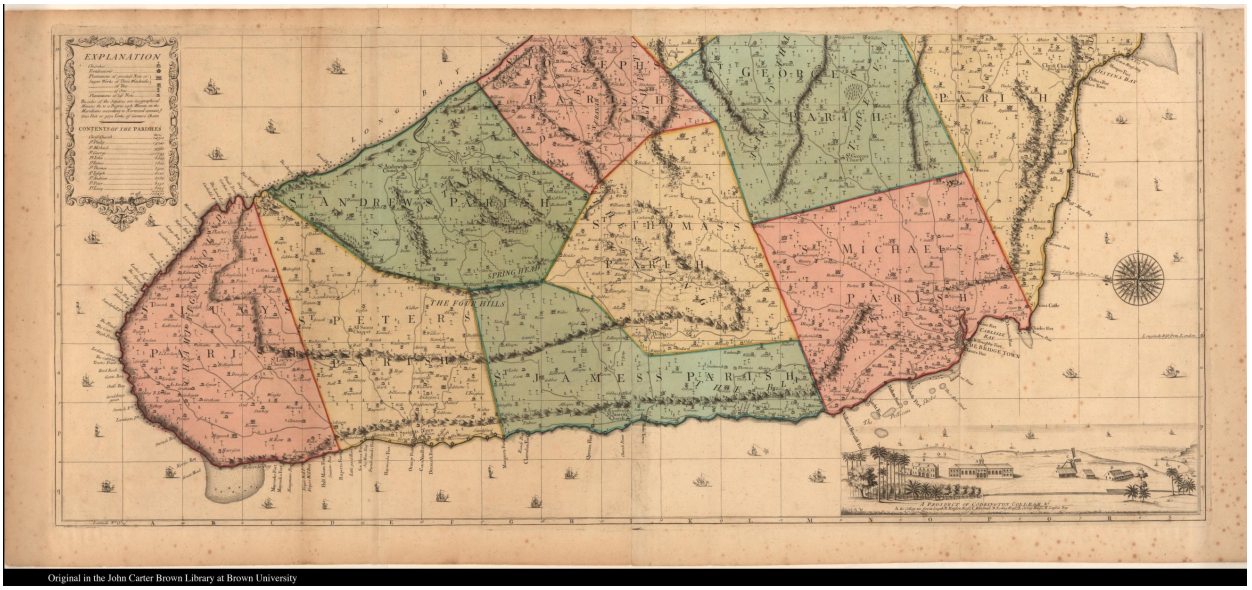
Figure 35: Philip Overton, *A new map of the island of Barbadoes* (1676)



Original in the John Carter Brown Library at Brown University

Figure 36: John Senex, *A new and exact map of Barbadoes* (1722)





Barbados was another example of how maps broadcasted the increasing density of English settlement of colonies. In 1675 Philip Overton advertised a map of Barbados as showing 'every parish, plantation, watermill & cattle mill is described with the name of the present possessors and all the things remarkable according to a late exact survey thereof' (figure 35).[58] It showed individual settlements dotted around the island, with rivers shown to connect almost all four corners of the island. However it did not divide the island into

[58] Philip Overton, *A new map of the island of Barbadoes* (1675)

parishes and Bridgetown appeared insignificant. In 1722 John Senex published a map that, by contrast, revealed earlier maps as sparse (figure 36).[59] It included the location of 'churches, fortifications, plantations of greatest note, of sugar works, of three windmills' – with 325 plantations in total marked. The highest concentration were in parishes of Christchurch (43) and St Peters (39), and the lowest in St Lucys (16). An inset showed the town plan of Bridgeport and listed 20 street names and places.

The potential of maps to make graphic pitches about the potential for lucrative imperial trade is also demonstrated in two maps of Newfoundland. John Seller published a map of Newfoundland in 1685 showing with detailed coves and inlets drawn around the Avilon peninsula, and the 'great bank of Newfoundland' drawn in an area on the map almost as large as Newfoundland itself (Figure 37).[60] Two insets showed Trinity harbor and St Johns harbour, with soundings and rocks marked; however the force of the message about trade was communicated in the elaborately-designed cartouche (60mm x 53mm). It shows a group of large and finely detailed cod, with tails poised as if to jump out of the map. A lobster, plaice, and eel join the cod, and underneath are two wide fishing nets, with a line of rope and floats running through the middle. Rather then emphasising the fantastical, the design of the cartouche promotes local natural resources and industry that could be manipulated by traders able to navigate the Great Bank and gain entry to the harbours. The functional and mundane navigation information in the banks and harbour insets sits alongside the finely designed and engraved fish and nets to create a combined image of a region that could yield significant results for a mariner or trader able to navigate the area.

Fishing in Newfoundland was promoted on another map of North America published in 1712, one fifth of which was dedicated to images.[61] An elaborate drawing showcased the stages of cod fishing and drying in St Johns harbour. Fishing lines extended in the ocean, and a ship stood in the harbour hauling in fish. On the dock people salted fish, and men carried cod in boxes to the water for treatment, after which the fish were laid out to be dried. Materials and techniques were also drawn - including the fishing line and hook, salt boxes on the dock, and casks in which fish wastage and oil was placed. Another image showed men moving seals from a boat into the harbour. Each part of the process was labelled with a letter, from A to M, and above the drawing a key explains each stage, with the title 'a view of a stage of the manner of fishing for curing & drying cod at Newfoundland'. It serves as a functional and instructive visual explanation of a core industry, promoting the region as worth investment and exploitation (for English colonists).

[59] Philip Lea, *A new and exact map of Barbados* (1722)
[60] John Seller, 'A mapp of new-found-land' (1685). The Great Bank was drawn as 230mm x 100mm at its broadest reaching 1mm at the tip, with three other banks measuring between 31mm x 16mm and 10mm x 10mm, whilst Newfoundland was 340mm x 190mm at its broadest
[61] Herman Moll, *To the right honourable John Lord Sommers […] this map of North America* (1712)

Figure 37: *A mapp of Newfoundland*, John Seller (1685)

Reproduced by permission of The Huntington Library, San Marino, California

Authority claims

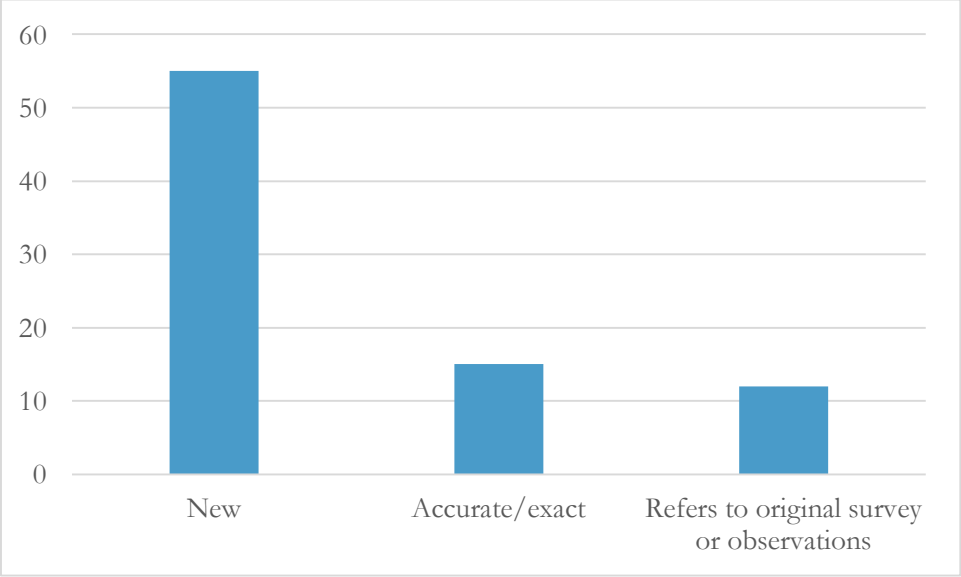
Publishers were producing and selling these maps in an environment with significant changes in the organisation and ideology of natural philosophy, and utility, accuracy and novelty became currency in selling for geographical information. Publishers made epistemological claims about their maps, asserting that their contents were sourced through eyewitness expert experience. According to this framework, the more accurate, the more novel and the closer to the source of information, the better a map was. These assertions were not separate to claims of value to colonists and mariners – instead, the asserted utility of the information was bound up with the value of colonial trade and settlement to Britain. These claims were made in the language of map titles and advertisements, textual notes on maps and charts, and in decorative images and cartouches.

Publishers employed linguistic strategies to assert attributes of utility and novelty. John Ogilby and John Seller both claimed their maps of Jamaica were '*novissima et accuratissima*' descriptions. [62] George Willdey

[62] John Seller, *Novissima et accuratissima Jamaicae description per Johannem Sellarum* (1675); Ogilby, *Novissima et accuratissima Jamaicae*

published a map of the world in 1702 that he claimed was 'A new and Correct map of the world. Laid down according to new observations and discoveries'.[63] William Berry claimed his 1680 map of South America was based on prestigious French map-maker Sansson, but that Berry has 'corrected and amended' it.[64] Figure 38 shows that in 181 map titles, 55 used the word 'new' to describe the map, and 15 used 'exact' or accurate'. Two used 'correct' and another used 'compleat'. Philip Lea and John Overton asserted that their 'new mapp of America' (1684) was the 'best and latest', while Edward Crisp claimed his map of Carolina (1711) was 'improved'. The remainder of map titles were single word such as 'America' or short titles such as 'A Map of America', indicating that although these did not use novelty or accuracy to advertise their maps, they also did not use other attributes to assert quality.

Figure 38: Words used in map titles to describe geographical information



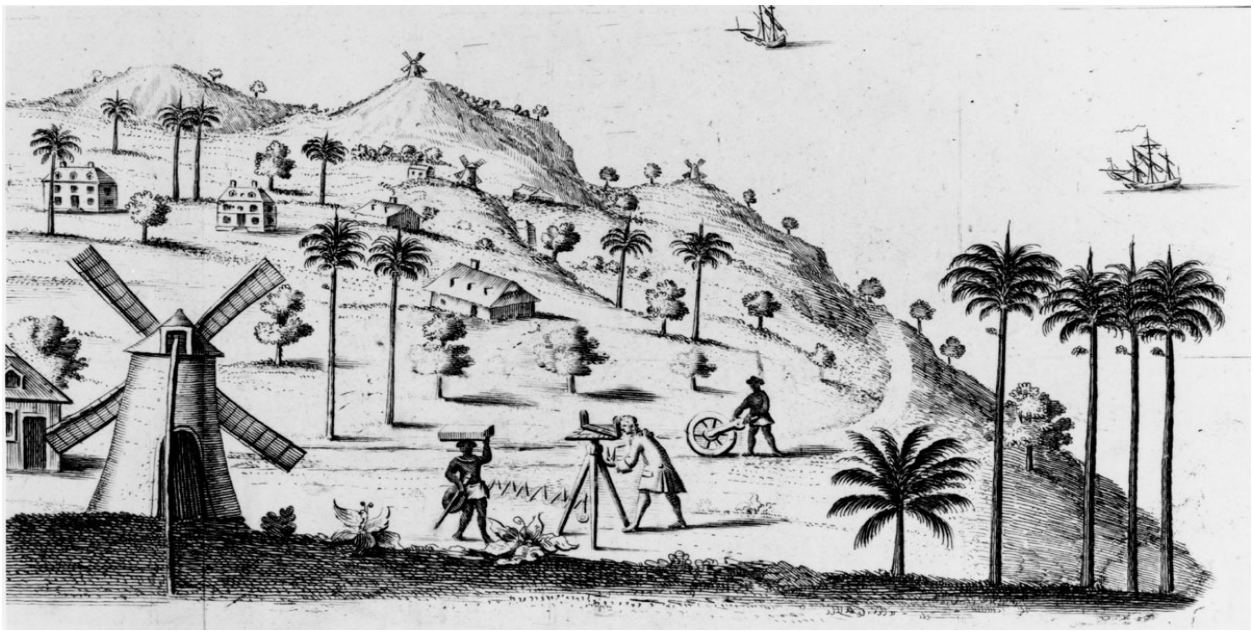
Some publishers referred to the eyewitness origins of information as a way of enhancing credibility. As shown in figure 38, 13 maps during the period included reference to empirical origins of the information on the map. On a map of Darien William Hack stated that 'the originall of this was taken by John Jenifer, late lieutenant of his Majesty's Ship Guernsey'.[65] William Mount claimed that his map of St Christopher was based on surveys by Surveyor General Richard Norwood.[66] Joel Gascoyne claimed in the *Term Catalogues* that his map of Carolina had been done by the order of the Lord Proprietors and was from 'the latest surveys'.[67] This claim to

[63] George Willdey, *A new and correct map of the world,* (1702)
[64] William Berry, *South America divided into its principal parts where are distinguished the several states which belong to the Spanish, English, Portuguese, and French,* (1680)
[65] William Hack, 'Part of the Indian empire of Darien in America' (1686) Add MS 5415.69 BL

[66] William Mount, *A new mapp of the island of St Christophers being an actual survey taken by Mr Andrew Norwood Surveyor General* (1706)
[67] Edward Arber, *The Term Catalogues, 1668-1709* (1903)

institutional backing and the novelty of the information were intended to emphasise the quality and uniqueness of his map. Charles Harper went even further in efforts to enhance the authority of his 'new and exact map' of Jamaica, emphasising that not only was it based on the most recent survey of the island by surveyors Humphrey and Knollis, but the original information was created using exact measurements taken with an 'gnoman', a surveying instrument.[68] A map of Barbados printed in 1720 included dense topological detail, a picture of a sugar mill and another of a gentleman using surveying instruments, aided by two men, presumably enslaved people (see figure 39).[69] In this case, evoking the use of mathematical instruments that could be precise and exact beyond the ability of the human eye was an additional articulation of the quality of the map. In this vision, not only was the map publisher selling correct information collected at source, but the original surveyors and the methods they used to observe the information were also precise and accurate.

Image 39: Detail on William Mayo *An exact map of Barbados* (1720)



Some publishers also claimed that they offered corrections to incorrect information printed by other publishers. Not only did this assert quality of their maps, but it also rendered previous publications as defunct. On his map of Barbados, John Ogilby commented that Heylyn's *Book of Chorography and History of the Whole World* was 'very short and erroneous in his description of the Caribbee Islands, especially of this island of Barbados, wherein I have been an inhabitant more than eleven years' and he corrects the length of the island.[70] Heylin claimed the island was 17 or 18 miles by compass, where as Ogilby's map claimed it was 22 in length and 14.5 in breadth. Publishers also made claims about their own authority to sell maps and charts. One method

[68] Charles Harper, *A new and exact map of the island of Jamaica with ye true and just situation of ye several townes and churches published* (1684)
[69] William Mayo, *An exact map of Barbados* (1720)
[70] Ogilby, *Novissima et acuratissima totius Barbadoes* (1671)

was by referring to institutionally-validated positions of authority in the production of geographical knowledge. John Seller was appointed Hydrographer to the King in 1671 and subsequently referred to the title on two maps in 1673 and 1685.[71] In 1707 John Senex and Charles Price called themselves 'Geographers to the Queen' in an advertisement for a new set of maps.[72] Some publishers also referred directly to the Royal Society in map titles, as a way of suggesting greater epistemological authority of the information. John Senex described his maps of North America and South America as 'corrected from observations communicated to the Royal Society in London and Royal Academy in Paris' in 1710 and 1715.

Of course, this is not to say that publisher's claims to present the newest and most accurate information were true. Publishers stood to gain both in terms of their reputation and commercially from claiming that their products were the most accurate and novel. The frequency of the claim to novelty and accuracy indicates that it was a form of social and intellectual currency that would enhance the quality of the map or chart in the eyes of the consumer. It suggests that although historians focus on aesthetic features as the main device used to encourage commercial viability - including the addition of colour to the chart or decorations - it is equally plausible that claims to utility and accuracy were as powerful hooks to the consumer.

Visual assertions of sovereignty and territorial ambition were not new, as indicated by the luscious 'Armada Portrait' of Queen Elizabeth I painted in the 1590s.[73] Elizabeth was shown with her hand placed on a globe, her palm laid loosely over the North American continent and her fingers pointing towards the Caribbean and South America. By the late 17th-century these expressions of aggressive ambition in visual culture had been joined by similarly ambitious but more innocuous expressions of aspiration in empire – English colonisation of the Americas had largely been achieved and the focus was now on settlement and economic exploitation. Maps called on ordinary mariners and settlers to play a role in empire, to make their fortune and expand England's borders. Analysis of maps of the Americas shows significant representation of information that promoted these colonies as places of economic value, productivity, a place to make ones fortune, and significantly, as being 'open' ie with enough space to settle in. Maps showed a mixture of open spaces, implying that there was potential for settlement and plantation (in context of rising population in England and declining wages), with visual detail such as rivers, windmills, plantation crops, harbours all indicating fertility, productivity, economic viability. They showed a balance of potential and proven viability for prospective settlers, merchants and planters in England. Appeal to utility and accuracy was a device to entice potential settlers and merchants into investing their capital and lives in this far away place, as an escape from

[71] John Seller, *A chart of the north part of America* (1673); *A chart of the West Indies from Cape Cod to the River Oronoque* (1685)

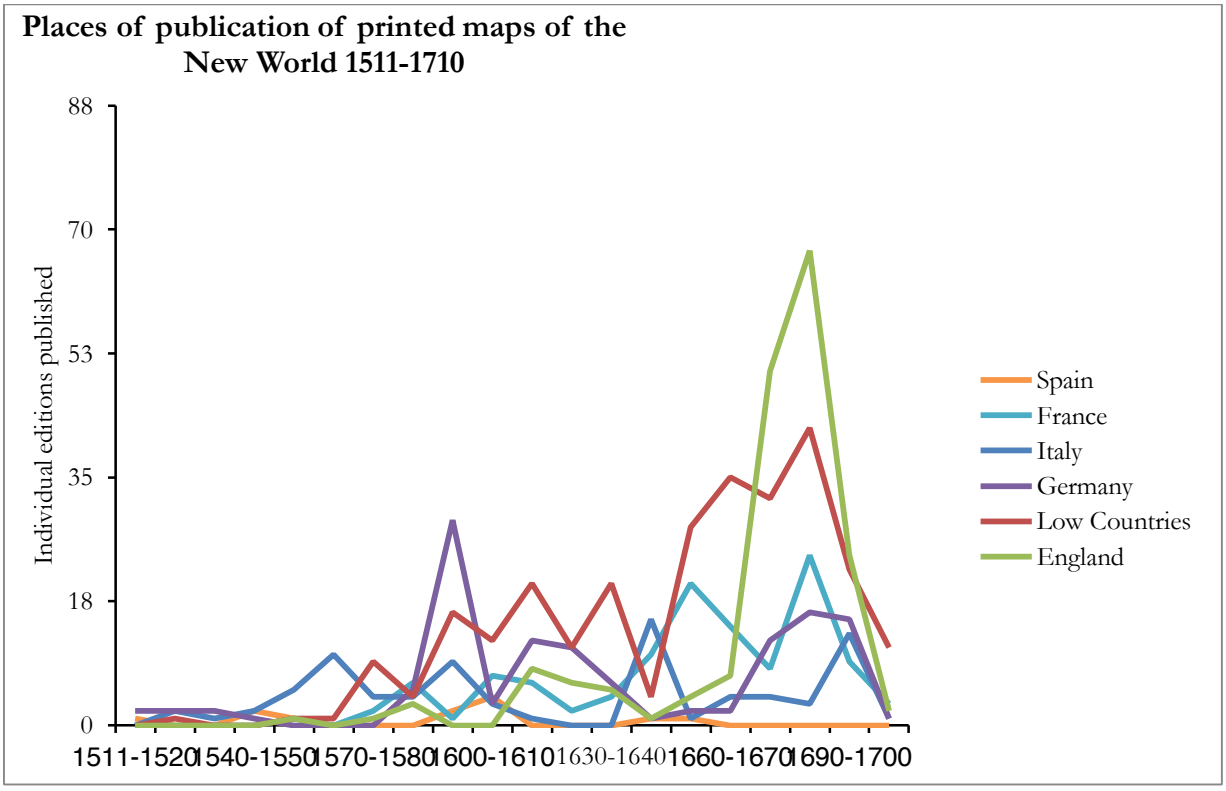
[72] This claim was challenged by Herman Moll and Philip Overton who had been until recently been in a business partnership with Senex and Price. The conflict over who could rightfully claim to be the Queen's Hydrographer indicates the potency of the title in asserting the status of the maker or publisher

[73] Armada Portrait c.1588. Woburn Abbey, England attributes the painting to English artist George Gower. However curators at the National Portrait Gallery, London argued in 2014 that the three versions of the painting must now be attributed to an unknown English artist. Tanya Cooper, Charlotte Bolland *The real Tudors : kings and queens rediscovered* (2014) pp. 151–154

England to a possible rich and productive future in distant land. The decision to include drawings of 'useful' instruments such as dividers, people surveying the land such as in the case of the William Mayo map of Barbados, fortifications, or commodities, rather than the more traditional sea monsters and exoticised encounters in the New World, hints at the perceived growing sensibility amongst the audience for these objects for useful information rather than fanciful decoration. Rather than using images of exoticism or 'others', maps produced in England were often simple, used undistinguished detail or recognisable images, and lack of decoration to sell the colonies, based on the message that viewers too could create a life and economic livelihood. Map publishers also stood to gain from expanding interest in geographies of the American empire - by making and selling greater numbers. The impact of demand on the trade reveals how the imperial project impacted on seemingly unconnected trades in colonial metropoles.

European trade in maps of the Americas

Figure 40: Comparative levels of publication of printed maps of the Americas, by European country, 1511-1710



Source: Map database

The first known printed map of the Americas was published in Seville in 1511 in an account of Vasco Nunez de Balboa's voyage to Pacific Ocean.[74] Publication of printed maps of the Americas across Europe remained sporadic until the mid-16th century, with 16 new editions between 1511 and 1552. Figure 40 traces the increase in volume of production as European colonial interests in the Americas grew, and as European print and book making skills and markets expanded.[75] By 1600 publishers in six European countries were producing maps of the New World. These were in Spain, France, Italy, Germany, Low Countries, and England, but the clear market leaders were Germany, Low Countries and Italy.[76] Map publishers in England joined the European trade relatively late. The first map of the New World published in London was printed in 1555 in an English

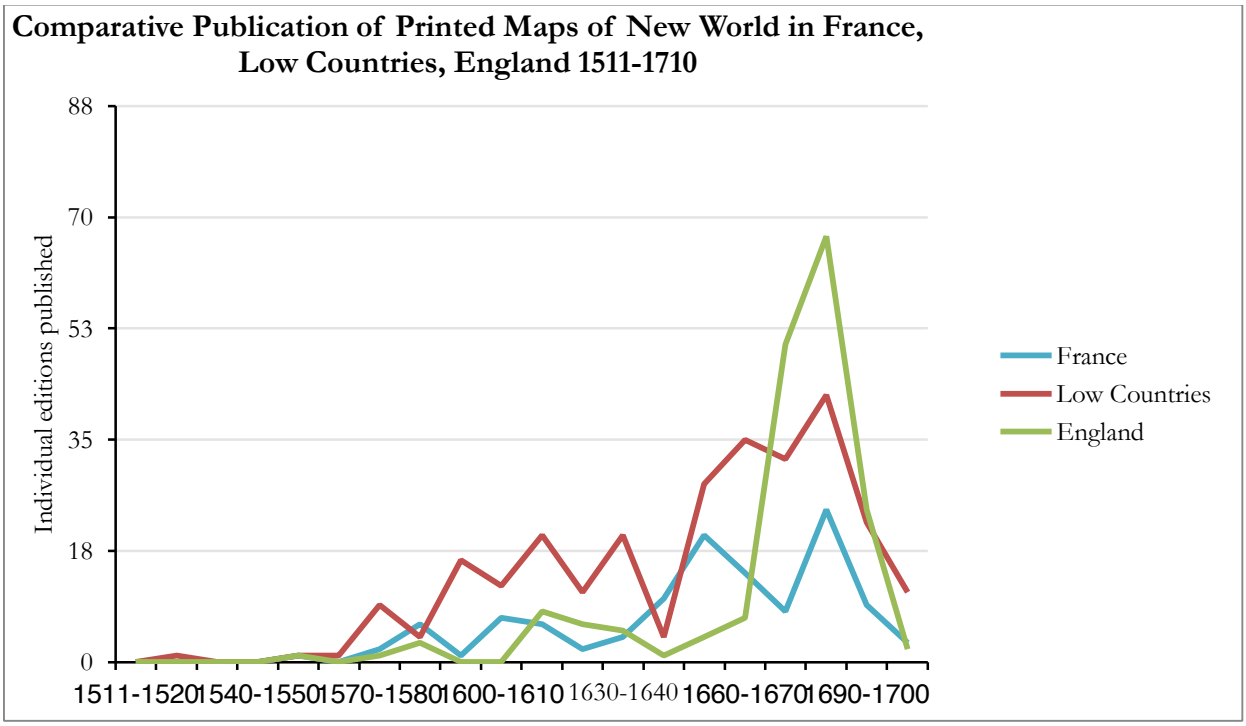
[74] Peter Martyr d'Anghiera, *Legatio babylonica occeani decas* (Seville, 1511)
[75] The data uses Philip Burden's bibliography of printed maps of North America and adds maps of the Caribbean and South America in library collections. It lists first edition maps only, and naturally it uses extant maps known to historians so the actual total number was probably higher
[76] A commercial trade in printed maps in Spain did not develop in a significant manner during this period but instead was largely under the control of the state

translation of Peter Martyr's (indeed it was one of the earliest maps printed in England). Between 1555 and 1610, another 4 editions of maps of the New World were printed in England, in contrast to 43 in the Low Countries, 37 in Germany, and 35 in Italy, indicating the peripheral position of England. Between 1610 and 1650 the European trade in Atlantic maps expanded, however the position of England remained relatively minor in this period, producing just 14% of all maps printed in Europe. This remained the case until 1660 when, as indicated in figure 16, England's role in the overall market changed rapidly from marginal to dominant as England's colonial investment and returns from colonial trade increased. Between 1640 and 1660, 5 maps of the Americas were published in London, and in the following two decades, 1660-1680, 57 maps individual editions were published - an eleven-fold increase.

This transition is represented more clearly in figure 41, which shows map production for the three market leaders in terms of volume of production. It shows that France and the Low Countries maintained steady and prominent positions throughout 1511-1720, but that London experienced a sudden rise from 1660 onwards. Between 1660 and 1710, a total 153 individual editions of maps of the Americas were available for purchase in London, which was 37% of the European trade. The Low Countries produced slightly less with 33% of editions published, and France far lower at 13%. This marked change in the position of London in the second half of the 17th century challenges the traditional historical interpretation of the European map trade and suggests that a more useful way of cutting the cake is by assessing the production of maps by European trades of specified geographical regions.

Figure 41: Comparative levels of publication of printed maps of the Americas: France, Low Countries, England, 1511-1710

Source: Map database



The position of English map publishers in the European trade was even stronger in publication of maps of areas of English colonial interest. Using the case study of the publication history of maps of Jamaica reveals that English map-sellers significantly outperformed European rivals in volume and pace of publication.

Ten printed maps of Jamaica were published in Europe between 1528 and 1646, by prominent cosmographers and authors such as Venetian Benedetto Bordone (see figure 42).[77] During this period, the dominant place of production moved from Italy in 16th century, to Amsterdam in the early-17th century. These maps depicted Jamaica as a circular island, with some river inlets, and just two towns marked, the capital St Jago de la Vega and Sevilla in the north. This reflected the limited development of the island by the Spanish.[78] Following the English invasion of Jamaica in 1655, maps of the island began to be printed in London, with a

[77] A list of printed maps of Jamaica are included in appendix 1. The information is from K.S Kipp 'Printed maps of Jamaica', *Map Collector* (1968) and from my own lists of extant maps in library catalogues. There were long periods of time when no new map of Jamaica appeared on the printed market. Generally map publishing was dominated by high-profile authors and cosmographers, and the maps of Jamaica were marginal to the publication. In Benedetto Bordone's large atlas the *Isolario* (Venice, 1528), *Jamaiqua* bears little resemblance to later depictions of the island by the English or 21st century conceptions of the island, and occupies half of one page.

[78] Clinton V. Black, *History of Jamaica,* 3rd ed. (Austin, Texas, 1969), pp. 33-35; Francisco Morales Padron, *Jamaica Española,* (Sevilla, 1952), p. *iii*

sudden increase in availability in the 1670s, as indicated in figure 20. The first detailed printed map was published by John Ogilby in 1671 (Figure 44).[79] A further five maps of Jamaica were published in the 1670s, and between 1661 and 1719, 80% of the printed maps of Jamaica in Europe were printed in London, indicating the shift of London's position in this specific market from non-existent to dominant following English conquest of the island.[80]

Figure 42: Number of new maps of Jamaica printed in Europe, 1520-1720

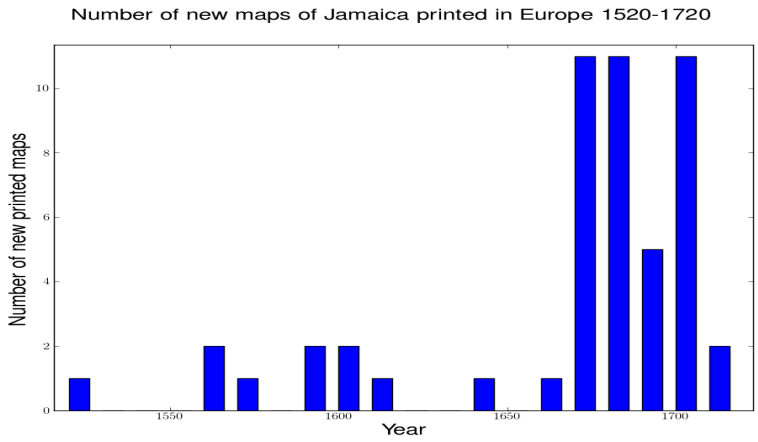
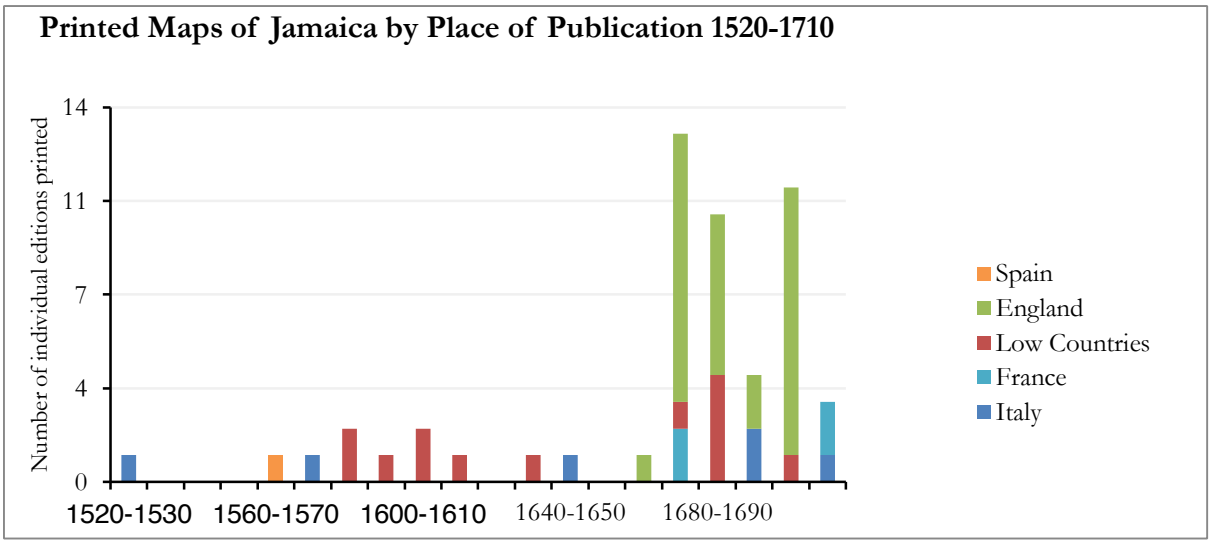


Figure 43: Printed maps of Jamaica by place of publication, 1520-1720[81]

Source*:* Data taken from Captain Kipp S Kapp, *The Printed Maps of Jamaica up to 1835,* Map Collectors' Series



[79] Ogilby, *Novissima et Acuratissima Jamaicae descriptio per Johannem Ogilium,* (1671, London)
[80] Collating contemporary advertisements, printed books, and extant maps, 41 printed maps of Jamaica in total were produced 1661-1719.
[81] The first map of Jamaica was published in 1528, in Benedetto Bordone *Isolario* (Venice, 1528)

In total, 41 maps of Jamaica were printed in London between 1661 and 1719 by 19 publishers. Just three produced multiple editions, including John Seller, who first printed a map of Jamaica in 1675 followed by two further editions which had slight variations in information.[82] Map publishers printed single editions of maps of Jamaica, some of which displayed a lot of new information, but they did not return to the map to add new information or release a second edition. This suggests that map publishers such as John Ogilby, Charles Harper and William Berry made the original capital investment in a new copper plate to produce new maps of Jamaica, but did not produce further editions or advertise multiple print runs. This suggests a lack of specialisation in publishing colonial maps, i.e., a consumer would not turn to a specific seller to purchase a map of the island. It also indicates high incentive to invest in publishing colonial maps. Map publishers may have been trying to capitalise on the growth of political and economic interest in the island in the 1660s and 1670s by investing in a new plate and printing a map, but demand may not have been sufficient to make it economically worthwhile to continue publishing maps of Jamaica. The trend of printing new maps with significant additions of topographical and geographical detail peaked in 1684, with a map printed by Charles Harper using information gathered by Charles Bochart and Humphrey Knollis.[83]

Representations of Jamaica developed more quickly than other colonies and it was the first American colony depicted with lists of plantations and their owners, as described above in Ogilby's Catalogue of Plantations' (1671). The representations of the island changed more quickly than other British colonies – this is linked partly to the rapid pace of colonial development of the island, but also indicates the pace of demand for information about the colony. Jamaica was also highly represented on regional maps of the Americas. In Philip Lea's map of the Caribbean (1685), Jamaica takes up half of the map, with dense inland detail, a key to settlements and plantation types, and an inset of Port Royal - by contrast, the rest of the English empire is sparse, with few places names and little topographical information.[84]

[82] Seller, *Novissima et accuratissima Jamaicae.* This map used geographical information from Ogilby's 1671 map but had a different cartouche. Philip Lea also printed two editions, the first in 1685 and another in 1700 in John Thornton's atlas *Hydrographia universalis,* which suggests that it was not published as a different map, but rather simply reprinted as part of an atlas, a common practice in the compilation of atlas. Lea, *A new mapp of the Island of Jamaica;* Lea, *The island of Jamaica* in John Thornton, *Hydrographia universalis* (1700)

[83] Charles Harper, *A new and exact map of the island of Jamaica* (1684)

[84] Philip Lea, *Generall map of the continent and islands which bee adjacent to Jamaica* (1685)

Figure 44: John Ogilby, *Novissima et accuratissima Jamaicae descriptio per Johannum Ogilium* (1671)

Original in the John Carter Brown Library at Brown University

London map trade

The London map trade operated in a commercial environment. Map publishers had to fund, or find patrons to fund, map production, which then had to sell if the publisher was to stay in business. Map publishing was not yet a distinct profession, rather it normally took place within of the larger book trade. According to James Raven, the book trade was flourishing. In 1649 there were 40 printing houses in London, this grew to 48 in 166, and by 1705 there were 70 printing houses and over 150 printing presses.[85] Raven points out that 'almost no book seller was an exclusive retailer of books, stationary, and print, but usually sold other goods besides'.[86] Some of these others goods were maps. For example, map seller John Senex received his training in the map trade from bookseller Robert Clavell and later joined the Stationers Company. A reliable assessment of the volume of map production for an individual publisher is difficult. Extant map collections are a useful but incomplete guide and suffer from survival bias, and a lack of publishers' business records make it difficult to

[85] James Raven, *The business of books: booksellers and the English book trade 1450-1850* (New Haven, Conn., 2007), p. 47
[86] Ibid, p. 49

gain a granular picture of the trade. Sarah Tyacke used newspaper advertisements placed by map publishers to produce a detailed study of map sellers in London 1660-1720, which can be used to look at history of publication of maps of the Americas.[87] Advertising in newspapers or specialist book catalogues was increasingly common in the late-17th century - the *London Gazette* in particular was a popular forum for advertisements, and with circulation of 7-8,000 copies in 1693, reaching 11,000 by 1705, its reach more than doubled rival newspapers *The Post Man* and *Post Boy*.[88] Tyacke's findings that an increase in map advertisements featured in the *London Gazette* indicated that the London map trade was expanding generally in the late-17th century. The study revealed biographical details and publication histories of 44 map sellers in London, however her work did not focus on whether the dynamics of the colonial backdrop to London's economic expansion in this period affected the map trade. By analysing the involvement of these map sellers in producing and publishing maps, charts and geographies of the Atlantic world, it is possible to assess the extent to which the trade responded to growing demand and what impact this had on the trade overall.

The number of publishers advertising maps or geographical texts about the Americas was one third of the total number of publishers, suggesting that one third of the trade capitalised on additional demand for information about empire. Of 44 map sellers advertising during this period, 14 sold maps, charts, atlases or geographical texts relating to spheres of British interest in the Americas.

Figure 45: Publishers advertising printed maps, charts, and books about the Americas, 1660-1720

Dates fl.	**Name**	**Activity**	**Type of Material Made/Sold**
1647-1686	Joseph Moxon	Publisher, engraver	3 single sheet maps; 1 sea atlas
1660-1676	John Ogilby	Publisher	4 single sheet maps
1660-1698	John Seller Sr.; John Seller Jr.	Publisher, book author	29 single sheet maps; 3 sea atlases (in numerous editions); 1 geographical book; 1 navigation text (authored)
1660-1705	Richard Blome	Publisher, book author	5 single sheet maps; 1 geographical book
1667-1708	John Thornton	Publisher	14 single sheet maps/charts

[87] Sarah Tyacke, *London map-sellers 1660-1720: a collection of advertisements for maps placed in the 'London Gazette' 1668-1719, with biographical notes on the map-sellers* (Tring, 1978)
[88] Ibid

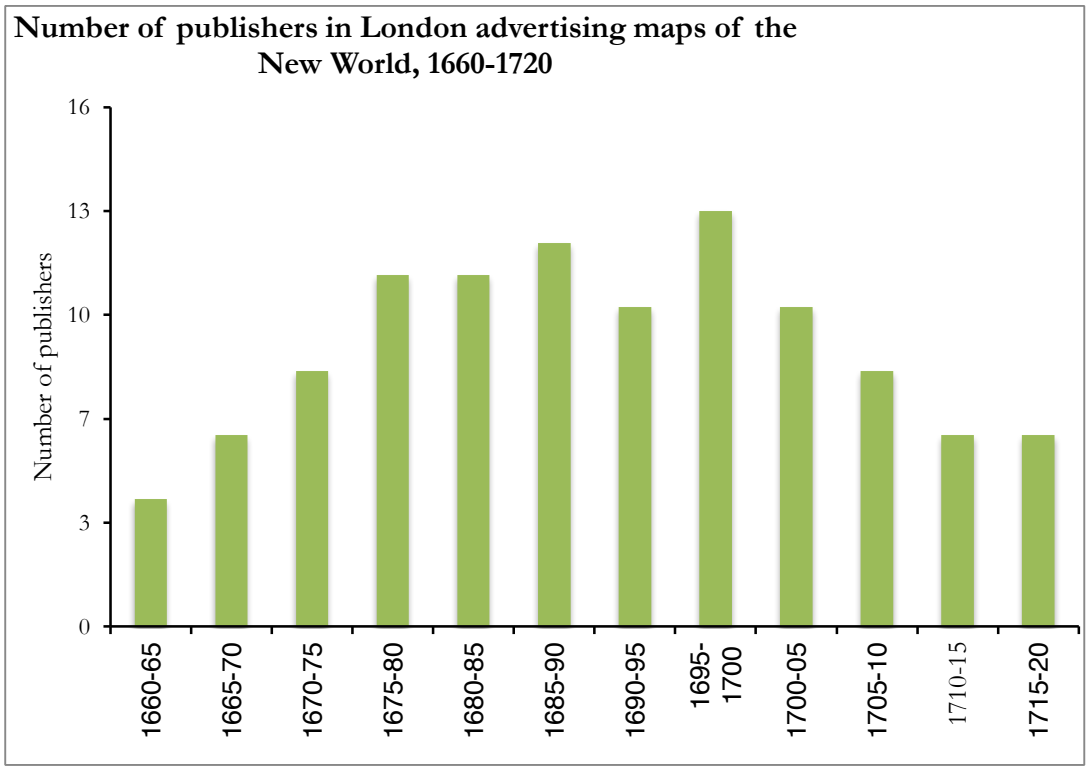
1669-1722	Robert Morden	Publisher	12 single sheet maps; 1 atlas; 1 geographical book
1671-1700	James Moxon	Publisher, engraver	4 single sheet maps
1671-1708	William Berry	Publisher	2 single sheet maps; 1 atlas
1678-1732	Herman Moll	Publisher, engraver	4 single sheet maps; 3 atlases
Unknown	Richard Mount	Publisher	2 single sheet maps; 1 atlas
Unknown	Thomas Bassett and Richard Chiswell	Publishers	4 single sheet maps
1683-1700	Philip Lea	Publisher	5 single sheet maps; 1 atlas
1697-1733	Charles Price	Publisher	Single sheet maps, atlases
1702-1740	John Senex	Publisher	5 single sheet maps
1631-1656	Thomas Jenner	Publisher	

The number of entrants to the trade accelerated between 1660 and 1720. Figure 46 indicates that the number of publishers advertising maps and texts of the Atlantic more than tripled between 1660 and 1700, from four active sellers in 1660-5 to a peak of 13 active in 1695-1700.[89] This increase suggests that map publishers responded to growth in demand by producing and advertising maps of the Atlantic and Americas. Some map-makers expressed professional jealousy and concern about overcrowding of the market. Robert Walton complained about 'intruders into that they were brought up to' and insinuated that maker Philip Overton had learnt to print and colour maps from 'his boy' apprentice. This indicates that the trade was becoming more dynamic, as publishers noticed new entrants competing with their established business.

[89] This figure was calculated by comparing the contents of map catalogues in the British Library, National Maritime Museum, Greenwich, and the Library of Congress, Washington D.C, with adverts in the *London Gazette*

Figure 46: Publishers in London advertising maps of the Americas in the *London Gazette* 1660-1720[90]

Source: Data taken from Sarah Tyacke, *London map-Sellers: 1660-1720* (Tring, 1973)



[90] This data is taken from Tyacke's list of map-sellers advertising in the *London Gazette* 1660-1720. Calibrating this list against another book catalogue *The Term Catalogues* does not add any more names to the list of map sellers, nor do extant maps in library collections

Figure 47: Number of new publishers advertising maps, charts or geographical texts about the Americas in the *London Gazette,* 1660-1720

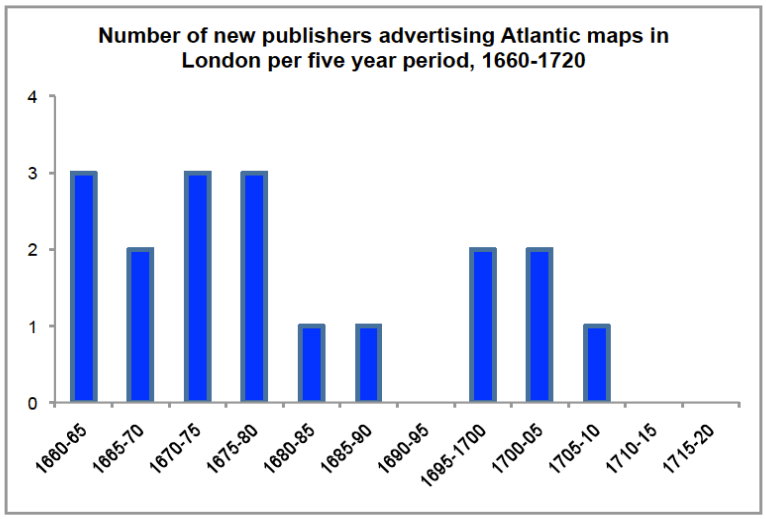


Figure 46 indicates that the steady number of publishers advertising maps of the Americas was not a reflection of continuity in the trade, but also that there were new entrants to the trade between 1660 and 1720. Figure 27 indicates that between 1660 and 1680 there were between two and three new publishers advertising maps of the Americas in each five-year period, totaling 11 new publishers entering the market in twenty years. Between 1680 and 1700 four joined the trade, and in the 40 years between 1680 and 1720, seven joined the trade. The capacity of the market to absorb new entrants further indicates that there was growing demand for these objects and geographical information.

Map publishing remained a precarious and unstable business. Although demand for information grew and the number of map sellers expanded, this did not seem to substantially change the financial position of map sellers during the period, as indicated by ongoing cases of bankruptcy. As in the earlier 17th century, there remained no Company devoted to map-making, and map publishers did not congregate into a specific one, choosing instead to belong to a variety.[91] All but one of the 14 map publishers sold their items from the area around the Exchange, Cheapside, or St Pauls, an area traditionally associated with the book trade, indicating that the trade had not developed to the point where it had its own spatial organisation. Only John Seller maintained two shops, one in the Exchange, and another, the 'Hermitage', in maritime London, in Wapping, alongside chart-makers such as William Burston and William Hacke. Map sellers frequently changed the location of their shops, or sold from Garaways Coffee House and Westminster Hall, and some eventually sold items from their homes.[92] On average, a map publisher changed shop address three times through the course

[91] Fourteen of the 18 map-makers selling Atlantic items were members of Companies; five in the Merchant Taylors, four in the Weavers, three in Stationers, and one in Drapers and Spectacle Makers

[92] John Senex and Philip Lea sold from their own homes, whilst William Morgan, Herman Moll, and John Seller sold maps from stalls in Westminster Hall as well as from their own shops

of their career, though some moved up to seven times as in the case of Richard Blome. Although this could indicate their desire to change the location of their trade to appeal to a different market, the bankruptcy of a number of map-sellers further indicates that there was significant financial instability.

This analysis correlates with trends in publication of Atlantic maps generally. A closer look at Figure 21 shows that, although the map trade was expanding in the late 17th century, and the number of people selling items about the Atlantic was also growing, this pattern changed at the turn of the century. The number of publishers selling Atlantic maps reached 13 in 1700, but it declined to six a decade later and remained at six until 1720. Furthermore, the percentage of items advertised in the *London Gazette* relating to the Atlantic was just 5% of the total number advertised.[93]

The diversity of makers and sellers of maps of the Atlantic throughout the period indicates that no clear dominance emerged according to geographical region or type of map on the whole. Nor did a distinction develop between booksellers and map sellers – the two trades remained within the same businesses. Distinction remained between chart sellers and map sellers, but with some crossover. Map-makers and sellers did not belong to a specific Guild or Company dedicated to map-making, and map publishers were divided between a number of different Companies. The trade did not expand evenly. After initial growth between 1660-1690, with growth in entrants to the trade, there were fewer entrants in 1700-1720 than previous forty years. This indicates that although the trade was able to respond to growing demand from imperial expansion, it was still precarious and had not established a firm footing by the early 18th century.

A map publisher's shop

Two surviving inventories give indications about the nature and size of publishers' businesses. They offer an insight into the shop interiors, including their size and equipment. Publishers Thomas Jenner and Philip Lea both kept shops as print sellers and publishers.[94] They sold maps as well as other prints or etchings and some books, and appear to have been respected and successful members of the trade who died with high-valued inventory and significant assets. Pepys visited Jenner's shop in the Royal Exchange in the 1660s and 1670s, and bought a collection of 16 maps of the world in 1666. Tyacke claims that Lea served as Samuel Pepys's map colourist and consultant on map-related issues.

When Thomas Jenner died in 1673 an inventory of his house and property was taken.[95] The shop goods were listed as including 2 world maps on cloth made by the Dutch maker Frederick de Wit (£1.4s), 100 of John Speed's country maps (18s), and 100 of Jenner's own maps at 8s. Jenner's possession of maps by other

[93] A total of twenty-two Atlantic maps were advertised in the newspaper between 1668 and 1720, out of a total of 410 adverts placed by map publishers. It is important to note that the 410 adverts do not all refer to maps. Some refer to geographical or navigational texts, mathematical instruments, notices of bankruptcy, adverts for subscription

[94] Tyacke and Worms discuss the biographies of Jenner and Lea. Tyacke, *London map-sellers*; Lawrence Worms and Ashley Baynton-Williams, *British map engravers: a dictionary of engravers, lithographers and their principal employers to 1850* (2011)

[95] Thomas Jenner inventory 27th January 1674, PROB 4/1117, The National Archives, London

publishers, including Dutch map-makers, indicates that some publishers purchased other maker's maps, perhaps to study the design or use some of the information on their own maps. It indicates too that geographical information crossed borders and further highlights, as suggested in the next chapter, the collective nature of map-making design as map-makers borrowed from each other to create new designs. It seems probable that the 100 copies of Speed's country maps were for sale in the shop. The valuation of the de Wit maps was significantly higher at £1.4s for two maps compared to 8s for 100 of Jenner's own maps. The de Wit world map was an intricately decorated double-hemisphere map, and the valuation indicates the higher value of maps printed on cloth. The other significant item in the shop inventory was 117 cwt of copper plates, valued at 2s.8d per pound, or a total of £41.16s.10d – or 298.6 pounds or 135kg of copper plates. This suggests a high capacity for Jenner to purchase copper plates, challenging historians' argument that plate production in London was limited. The total value of Jenner's shop goods was estimated to be £187.10s.6d. The shop property and lease on the shop were valued at £312.16s.9d. The valuation of Jenner's stock and his business suggests that he was a far cry from a publisher who could not afford to invest in engraving or in copper plates, further suggesting that publishers in the mid to late 17th century invested in engraving map designs. It could be possible that Jenner was wealthy *because* he did not invest in engraving or plates, however evidence from comparison of map images that suggests a high level of different information incorporation between maps suggests that publishers did have to pay for engraving or re-engraving.

Philip Lea was also a successful publisher, who, in addition to other items, also published a number of maps and charts of the Americas. An inventory from his shop the 'Atlas and Hercules' in 1700 reveals some details about the shop interior.[96] It included 'press counters and drawers' (valuation £2.10s), indicating that it was open to customers to enter the shop and view the maps and charts for sale. It seems probable that the drawers held the collections of maps and charts that were produced during the print runs, and perhaps some were held there for display. The number of items recorded as part of the stock, including £40 worth of books, £20 of brass, wood instruments and 16 cwt of copper plates suggests that it was a relatively large space, that could accommodate both storage of these bulky items, space for display, space for commerce, and space for customers to talk with Lea or apprentices in the shop and view items for sale. A printing room attached to the shop was described in the inventory. It described the room as separate, probably in the back of the shop or above (although this would have made it difficult to transport heavy printed items). The room contained a rolling press for printing, as well as an 'old chest of drawers and table'. The situation of the printing room behind the main shop, and containing the rolling press and old drawers and table makes the space sound strikingly similar to the rooms depicted in the Stradanus image of a print workshop described in the next chapter. The combination of commerce, useful instruments and books, an artisanal workspace in the same

[96] CLA/002/02/01/2444, London Metropolitan Archive

building or space indicates the type of environment that map publishers and printers could be involved in creating in 17th century London.

Stock included books in quires suggesting that were either loose-leaf or folded together as well as books that were bound. These were valued at £40.8s suggesting that they were in high number, and also indicating the diverse nature of Lea's business. Mathematical instruments 'of brass and wood of all sorts' were also included, valued at £22.10s.6d, again indicating the breadth of items Lea sold. 'Sea card prints' were valued at £35.15s, and a 'parcel of mapps made upon cloth' at £8. Also, globe plates were included in the shop, valued at £10. Finally 16 cwt of copper at 18d per pound, valued at £132.8s was included. Like Thomas Jenner, Lea was clearly able to support purchasing high amounts of copper. The overall stock was valued at £266.11s.6d, and total assets at £337.5s.10d. The valuations of stock and assets of Jenner and Lea were not dissimilar to the valuations of Robert Green and James Moxon. Robert Green's books and maps were valued at £117.13s.7d, and total estate at £326.12s.8d. James Moxon's total stock value was £1584, according to an evaluation he himself published in 1698 as part of a lottery proposal.[97]

George Willdey also recorded costs related to a map of North America 'in two sheets imperial paper' in 1710, produced in partnership with John Senex and John Maxwell. The costs are listed as 'the map graving of copper', £20.0s. 0d, a payment to Mr Bandergulls for the 'compartment', £3.10s. 0d, and the printing and pasting of 550 maps, costing £1.26s. 0d. The total cost to Willdey, Senex and Maxwell for producing 550 maps was therefore £25 16s. 0d. This was a considerable investment to produce one edition of a map. Willdey listed the sale of 50 maps in 1710 at the price of 10d each, which is roughly equivalent to prices charged by other map-makers.[98] In addition to engraving and printing, retailing costs would have further contributed to the cost of production, indicating that the partnership would have had to collectively sell 600 copies of the map before making a profit.

[97] Bagford Harl. 5947.72, British Library. The total stock value was £1584, composed of 4110 copies of 21 book titles, 8 types of instruments totalling 326 items, 400 sets of geographical and astronomical cards, and 606 copies of 5 maps. In a total of 5482 items, 606, or 11%, were maps. The value of the maps was £265, with around half sold at £2 each and the remainder at £1, making the maps 17% of the overall value of Moxon's stock in 1698

[98] In 1685 Philip Lea advertised a large sheet map of Jamaica for 1s, and in 1684 a new large sheet map of America was advertised also with price of 1s

Chapter 7: The mapmakers' workshop

Figure 48: Depiction of copper-plate engraving and printing in Hans Collaert after Jan van der Straet Stradanus, *Nova Reperta* (Amsterdam, c.1599-1603)[1]

In 1580 Flemish artist Jan van der Straet produced a set of engravings called 'New Discoveries' that illustrated new technologies that had developed alongside the discovery of America, and celebrated the departure of an older way of doing things as new inventions became available. One engraving depicted a workshop printing images from engraved copper plates. It provides a useful, if idealised, insight into the labour, skill and materials required in map production from copper plates. The workshop is busy. On the far right, an engraver wearing glasses points at a partially-engraved copper plate, and around his hands are tools used in engraving, including a burin and scraper. Next to him, two men prepare the engraved plates for printing; in the foreground, one holds a plate to be inked, whilst at the far end of the table, another daubs a plate to remove excess ink. The rolling press stands in the left of the picture. It is a large piece of machinery, occupying almost half of the workshop, and requires three men to perform the printing. One man stands holding a plate, perhaps waiting for the press to complete its current impression. A young man is pulling down on the levers to push the paper over the plate between the rollers in the press. A third man stands observing the process, perhaps checking the quality of the impression. Behind the press, a man adds a print to rows of already-printed pieces. Through the door in the middle of the image, we can see into another workshop churning out prints.

[1] Hans Collaert after Jan van der Straet, called Stradanus, Sculptura in aes (engraving in copper): plate 19 of the nova reperta (new discoveries), in *Heilbrunn timeline of art history* (New York, 2000) http://www.metmuseum.org/toah/works-of-art/49.95.870(10) accessed 23 March 2014

Straet's engraving captures the industry and skill of printed map production, but this representation of production in a single, self-contained, smooth-running workshop does not mirror the production process in late 17th-century London.[2] The suggested ease of transfer of drawing to the engraver, to the 'inkers' on the next table, and finally to the printer does not represent the probably atomised skill and labour of print artisans in London. The apparently Smithian dream of specialisation appears to have rested upon tradition of division of labour in book and print trade, rather than innovation. Similarly, the realities of commerce and consumption are not represented. The influences of a patron on the design of the map, the effects of unpredictable supply of raw information and consumer demand, and the realities of costs of materials and labour were all economic concerns that affected early modern publishers. It also does not indicate the contingency artisanal skill injected into graphic representations of geography or the far-reaching ramifications that artisanal labour could have upon cartography. The skill with which a piece of paper or copper plate could be manipulated by hand to create a desired effect had significance beyond aesthetic impact. It determined the quality of transmission of geographical information to an audience beyond those who could first-hand experience the places represented. A bad artisan in the workshop could alter the geographical representation of the Americas for map consumers across Britain, even Europe.

But Straet's image does capture the significant technical and artistic skill in the printed map trade. The glasses on the face of the engraver imply the need to closely work with the plate in order to engrave correctly (it also suggests the impact on his eyesight of a career of careful attention). Two apprentices watch him, highlighting the training required to become a good engraver. Similarly, the boy hunched and clutching a piece of paper and pen to his chest as he copies from the image on the table suggest a process of dedicated practice and application in becoming a draftsman that began at a young age as apprentice. Straet's workshop is one that demanded high input of labour (nine men and three apprentice boys are working), with varying degrees of requisite intensive work, skill and precision, and a significant number of tools and machinery (there are six different tools and one printing press). It raises a number of questions about the nature of a 'map-makers workshop' in the context of maps of the Americas. What type of labour and skill was involved in each stage of production? How labour intensive was this process and what were the costs? Crucially, what does the skill and labour involved in map production indicate about the role that demand for colonial geographical information played in the market for skills in London, and the role that print artisans played in creating colonial geography.

These questions have not been focussed on by historians, despite work by G.R. Crone, Arthur Robinson, David Woodward, Moreland and Bannister who describe changes in map-making techniques

[2] J.B. Harley discusses this separation of skill and diversity of map publishers' businesses in relation to 18th century atlas makers in London. J.B. Harley, 'Power and legitimation in the English geographical atlases of the eighteenth century' in John A.Wolter and Ronald E.Grim eds., *Images of the world: The atlas through history* (New York, 1997), pp. 124-127

between the Renaissance and the 18th-century.[3] However there is little acknowledgement in these accounts of the relationship between the nature of materials, costs of labour and materials, the artisan's skill, and the ability to present geographical information.[4] On the other hand the role of artisans in creating natural knowledge has been discussed by historians of art and science, who recognise that print technology was vitally important in transforming a knowledge culture where textual and visual information was available to a select few by virtue of the restrictions of manuscript recording, to one where information could be reproduced, bought and sold to increasingly wider circles.[5] This relationship of the importance of replicability of information to technology and artisanal skill has also been identified in the ability of artists to draw 'natural life' and Pamela Smith has argued that artisans were the 'motors' of the Scientific Revolution.[6] Celina Fox began to address the largely unexamined question of artisanal skill in her work on the mechanical arts during the Enlightenment and industrialisation in Britain. She writes, 'for centuries, drawing constituted the easiest and most immediate form of expression across a whole spectrum of the mechanical arts. It required simply the eye and hand, pen or pencil and paper.'[7] Despite Fox's call for attention to the relationship between drawing and industry, the links between artisanal skill and economic development have not been widely examined. Although the relationship between art and empire has been assessed by art historians, and some historians, this has often focussed on the visual nature of art in constructing empire, and the role of the skill and labour of artists in empire has not been focussed on.[8] Historians of empire have considered the skills and industries that supported empire and benefitted from imperial expansion, for example insurance, sail-making or ship-building, however they have focussed less on trades and activities that seem at first glance to be peripheral to empire. In the case of the British empire, demand for maps and charts provided work and put pressure on the skills of print artisans such as draftsmen, engravers and printers.

This chapter has three aims. Firstly, it explains the technical processes of drawing, engraving and printing and highlights the significant scope of labour and skill involved in producing maps and charts of the Americas.[9] Analysis of the graphic contents of the maps and charts, and the work involved even in changing a map title or substituting Dutch for English place names, indicate that historians' assessment of London map-makers as unskilled or lazy does not capture the full scope of work involved. The traditional distinction between

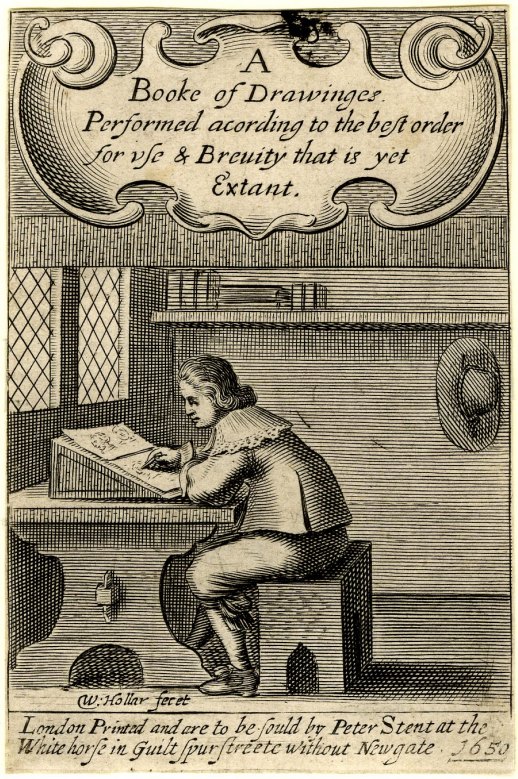
[3] G.R. Crone, *Maps and map-makers: an introduction to the history of cartography* (1953); Arthur H. Robinson, *The look of maps: an examination of cartographic design* (1952); David Woodward ed., *Five centuries of map printing* (Chicago, 1975); Carl Moreland and David Bannister, *Antique Maps* (Oxford, 1989), pp. 11-19
[4] Mary Sponberg Pedley, *The commerce of cartography: making and marketing maps in eighteenth-century France and England* (Chicago, 2005); J.H. Andrews, *Maps in those days: cartographic methods before 1850* (Dublin, 2009) pp. 355-363
[5] See essays in Lissa Roberts, Simon Schaffer, Peter Dear eds., *The mindful hand: inquiry and invention from the late Renaissance to early industrialisation* (Amsterdam, 2007)
[6] Michael Baxandall, *Painting and experience in fifteenth-century Italy* (Oxford, 1988)*;* Pamela Smith, 'Art, science and visual culture in early modern Europe' *ISIS* 97: 1 (2006) pp. 83-100; Svetlana Alpers, *The art of describing: Dutch art in the seventeenth century* (Chicago, 1983); Smith, 'Art, Science and Visual Culture', p. 91
[7] Celina Fox, *The arts of industry in the age of Enlightenment,* (New Haven, Conn., 2009), p. 45
[8] Kim Sloan, *New world: England's first view of America* (2007); Wayne Craven, *Colonial American portraiture: economic, religious, social, cultural, philosophical, scientific and aesthetic foundations* (Cambridge, 1986)
[9] Unfortunately comprehensive business records of a map publisher have not been found, which makes it difficult to conduct a thorough empirical assessment of the costs and labour involved in the trade

art and science is further eroded by this study, which shows that map-makers had to combine skills in precision drawing with graphic skills to present coherent but appealing images. It also highlights the crucial role that artists played in constructing images and knowledge of the British Atlantic empire, indicating that although artisans were thousands of kilometres away from the colonies, their skill was instrumental in creating graphic impressions of empire. Furthermore, the accuracy of graphic understanding of empire rested on the tactile and visual skills of draftsmen, engravers and printers in London, who probably played the role of ignorant rather than willing interlocutors in empire. The artisan's hand, as well as the physical aspects of paper size and printing press size, could equally constrain the graphic view of the American world, again highlighting the instrumental role played by artisans in constructing images and knowledge of the American empire. The chapter also makes estimates of the costs of map production, using previously-unexamined payments by publisher George Willdey to engravers in account books in the National Archives, and a copper plate for a book frontispiece in the Company of Scotland accounts in National Library of Scotland. Cost estimates by historians Sarah Tyacke and Anthony Griffiths are also used. Finally, the chapter uses comparison of sequences of maps of the same geographical area (for example Jamaica) to estimate how much labour was required to produce changes in detail between the images and whether those changes were possible without significantly re-working a plate or making a new plate. This analysis suggests that 95% of maps and charts of the Americas published in London between 1660 and 1720 probably required significant re-engraving or the production of a new copper plate and that the remaining 5% used plates that had been partially re-engraved to change information. This highlights the far-reaching impact of imperial expansion on the use and application of human capital in the metropole and contributes to historians' understandings of links between empire, science and art by highlighting that artistic skill in London was crucial to the development of an imperial geography.[10]

[10] Ibid, p. 450

Drawing

Figure 49: A draftsman at work in *A booke of drawinges* (1650)
Image courtesy of British Museum



Seventeenth-century depictions of drawing often showed a man hunched over a desk in a sparsely-decorated room, industriously applying a pencil in his hand to paper in front of him.[11] Rather than a protracted artistic task requiring lofty visual gymnastics, drawing or drafting was often shown as a manual task, involving industry and application. This type of precision drawing was the first part of the process of printed map and chart production. An image had to be prepared for an engraver to engrave into the copper plate. The complexity of map designs suggest that they were not drawn by publishers or by engravers, who were unlikely to have the necessary competency. The scope of influence of draftsmen over the graphic design of a geographical region should not be underestimated. Colonial settlers, mariners, and merchants may have been the first Europeans to see the British American empire, but the graphics of early empire were designed and produced by artisans in London thousands of miles from the colonial periphery. Analysis of the 181 maps of the British Atlantic world published in London between 1660 and 1720 indicates firstly that the growing market demanded higher volume of work by artisans than is usually considered by historians. Secondly, drafting a map of the Atlantic colonies was both a mathematical and an artistic exercise - it demanded abilities in precision drawing, graphic conceptualisation and decorative pictorial drawing. The ability to draw coastlines and navigation information

[11] Peter Stent, *A booke of drawinges* (1650); Anonymous, *The excellency of the pen and pencil* (1668)

was particularly important. Thirdly, draftsmen were engaged in creating a collective graphic impression of the Americas - lack of effective intellectual property rights in the print market meant that publishers could combine multiple sources of information to create new designs of the Americas colonies and images of colonial geography moved easily through the trade. The majority of cartographic information was derived from multiple and multivalent sources - other printed maps, manuscript maps, printed texts - creating a 'cut and paste' method in map design, whereby draftsmen applied skills in information selection, re-sizing of visual information, and coherent design. The chapter highlights that human capital associated with map production was driven by external demand, but that the commercial nature of the market created specific internal mechanisms that altered the type of skill in demand.

Scholars in the history of cartography have not devoted significant attention to the importance of drawing. Sarah Tyacke mentions copper-plates, paper, colouring, rolling-press printing and engraving in her essay on the London map trade from 1650 to 1710, but she does not discuss drawing.[12] Lloyd A. Brown described the visual components of early modern maps and charts and noted that 'elaboration of conventional signs usually depended on the ability of the artist and engraver' but did expand on this skill.[13] Unlike drawing prints or portraits, where the determinant of quality of the image was its fidelity to a subjective view of the subject or object, the quality of drawing on maps was determined by the extent to which it faithfully captured the geographical information it was derived from. In this sense, it was both an artistic and a mathematical exercise. John Evelyn wrote that the key to good drawing was practice and experience. He emphasised a link between the hand and artisan's mind - a good drawing was one that achieved 'a visible expression of the hand resembling the conception of the mind'.[14] Tools were also required. One manual (1678) described seven tools used in drawing; charcoals, duck feathers, black and red lead pencils, pens made of ravens' quills, rulers, compasses, and pastils or 'crions'.[15] A draftsmen used charcoals sharpened into pencil to 'draw lightly the draught over at first', and feathers could be used to remove mistakes. Black and red lead pencils were then used to create a second layer, before a pen made of raven quills was used to finish the drawing. In addition to technical skills, mathematical knowledge was believed to be required. One manual explained that in order to achieve perfection, 'it is necessary that he [draftsman] should not be ignorant of Mathematical Demonstration in the Rules of Geometry and Perspective'.[16] It advised the use of rulers, which could be used in drawing 'straight, or perpendicular lines, Triangles, Squares or Polygons', and a compass would ' measure (by help of a curious Scale of equal Parts upon the edge of your ruler) your proportions, and whether your work is done

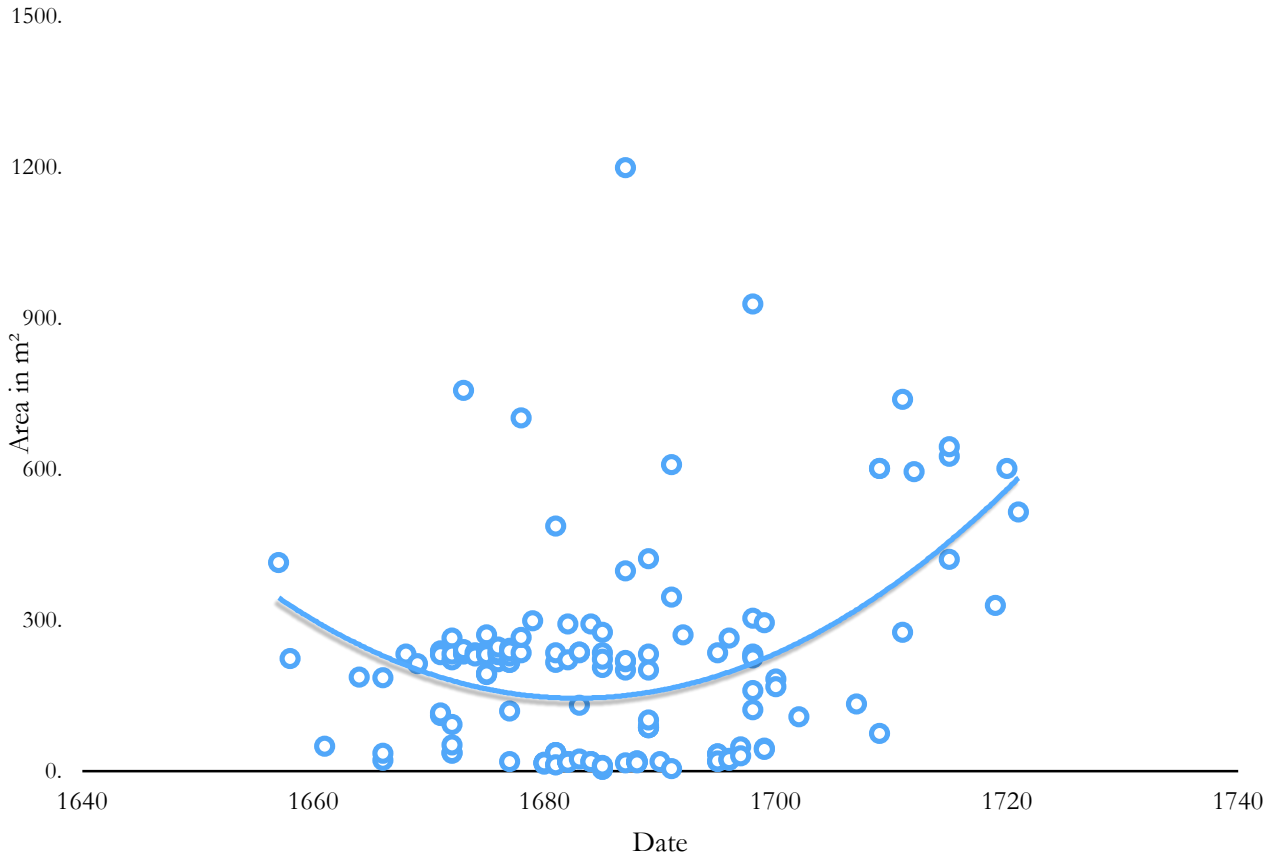
[12] Tyacke, *London map-sellers*
[13] Lloyd A. Brown, *The story of maps* (1980), p. 175
[14] John Evelyn, *Sculptura* (1662), p. 105
[15] William Salmon, *Polygraphice* (1675), pp. 2-3
[16] Anonymous, *The excellency of pen,* p. 1

exact which is done with charcoal. Secondly, to draw circles, ovals and arches'. These instructions indicate that the task of drafting required complex understanding of geometric principles and use of tools to create images.

The volume of information drawn and designed by artisans on maps of the Americas should not be under-estimated. Although maps and charts of the Atlantic varied in size - the smallest was 35 x 65mm and the largest 850 x 1410mm - the median size was 395 x 500mm, as seen in figure 50.[17] The majority of maps were dense in information, with little unused space in the design, indicating that a draftsman filled an area of almost 2000cm² with information when designing a map of median size. These designs required conceptualising, plotting and executing. In total draftsmen making maps of the Americas in England drew at least 30,5000m² of graphic information. Over the period the size of maps increased slightly, which meant that a single publication involved more drafting labour in the 1700s and 1720s compared to the 1660s or 1670s. This also suggests that publishers were willing or able to invest more in single publications as they spent more money on labour (a larger map would have taken longer to draw and therefore had higher labour cost).

[17] John Seller published a 35x65mm map of New England (no title) in 1685 in *Almanack for the province of Virginia & Maryland.* In 1687 Thomas Holme published *A map of the improved part of the province of Pensilvania in America* in six sheets, totalling 850 x 1410mm in perimeter

Figure 50: Map size (in area) of printed maps and charts of the Americas 1657-1721
Source: Map database

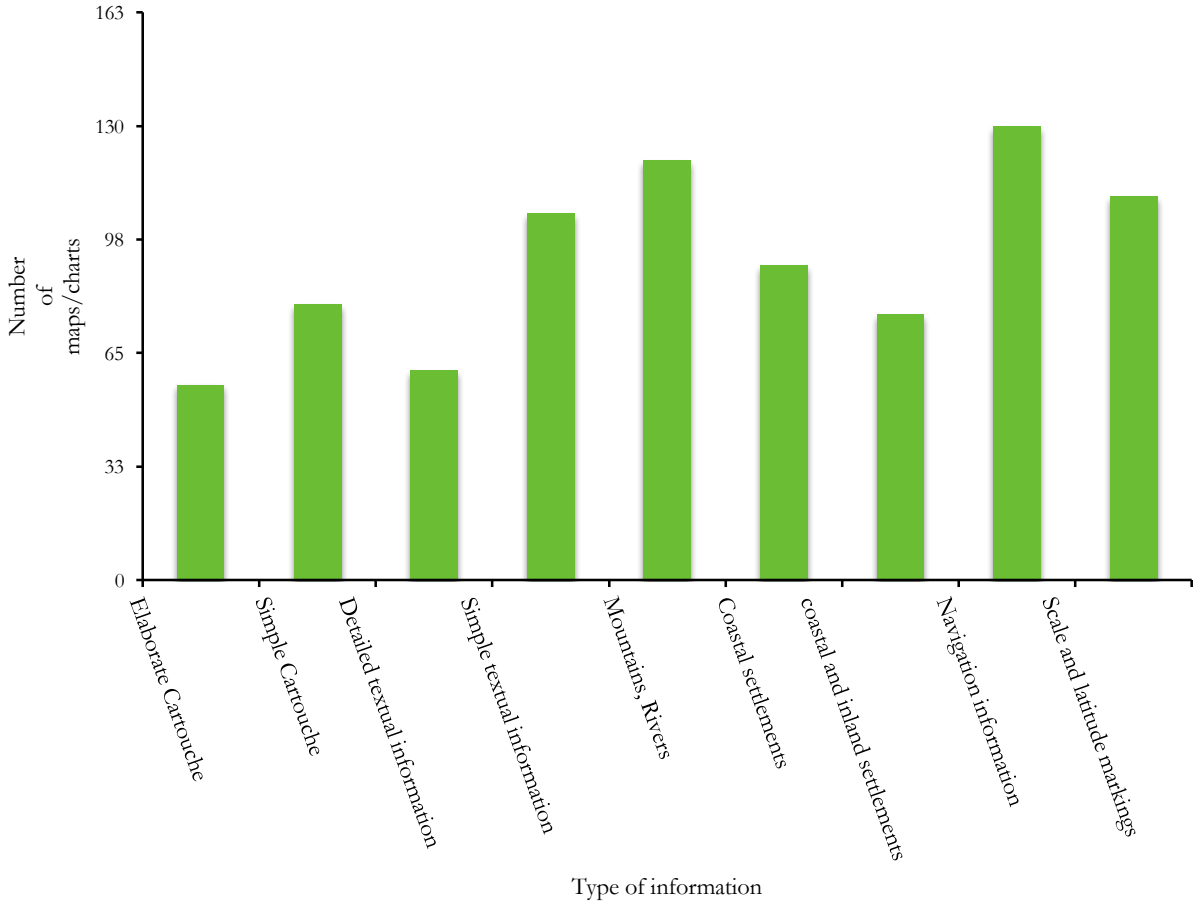


As seen in figure 51, the majority of maps contained a variety of geographical information, including rivers, settlements, harbors and coastlines. Charts also contained navigational information, such as harbours, soundings or rock marks, as well as rhumb lines that criss-crossed the whole image. Each of these individual components had to be graphically conceptualised, designed and drawn by hand. Decorative information such as a cartouche, drawings of animal or plants, and topographical information like rivers or mountains drawn in pictorial form were comparatively minor. 60% of maps and 60% of charts published contained no pictorial drawings. On the remaining 40% of charts the median number of drawings was three, usually of ships around 20mmx20mm each. The remainder of maps have a median number of eight drawings, with the maximum number of 34, on *A New and Exact map of America* published by John Garrett in 1666.[18] Just two charts had

[18] I counted the drawings on 53 surviving printed charts from 1660-1720. I defined a drawing as any graphic information that was not intended to communicate literal geographical information. This included ships, sea monsters, animals, fish, flora. I did not count compass roses, as these had a function in indicating the orientation of the chart. I also did not include trees or mountains, which were pictorial but not intended as decorative. I also did not include insets, which were usually of harbors or sometimes of scenes of trading, because they were usually much larger and denser than the drawings of ships or animals

pictures of sea monsters.[19] Many had borders with latitude marks, a scale ruler, and a title, which varied in style but the majority stated the geographical focus of the map and the publisher's name and address. Some maps also included notes with additional geographical or navigational detail, as described in the previous chapter.

Figure 51: Geographical information on maps of the Americas 1657-1721



Just one of the 179 maps and charts did not show coastlines. Coastlines were usually depicted by a line distinguishing between the land and the sea, and with indents to indicate coves, inlets or rivers, as well as navigation information such as rocks, shoals, sand banks and water depths near to shore. The manual work of drawing a continuous line was probably relatively simple, involving drawing a line with various indents and undulation, but it required precision and care if it was to reflect the raw information. Drawings of bays, sounds, harbours and rivers were a crucial part of depicting a coastline, and involved minute shifts of angle and lengths

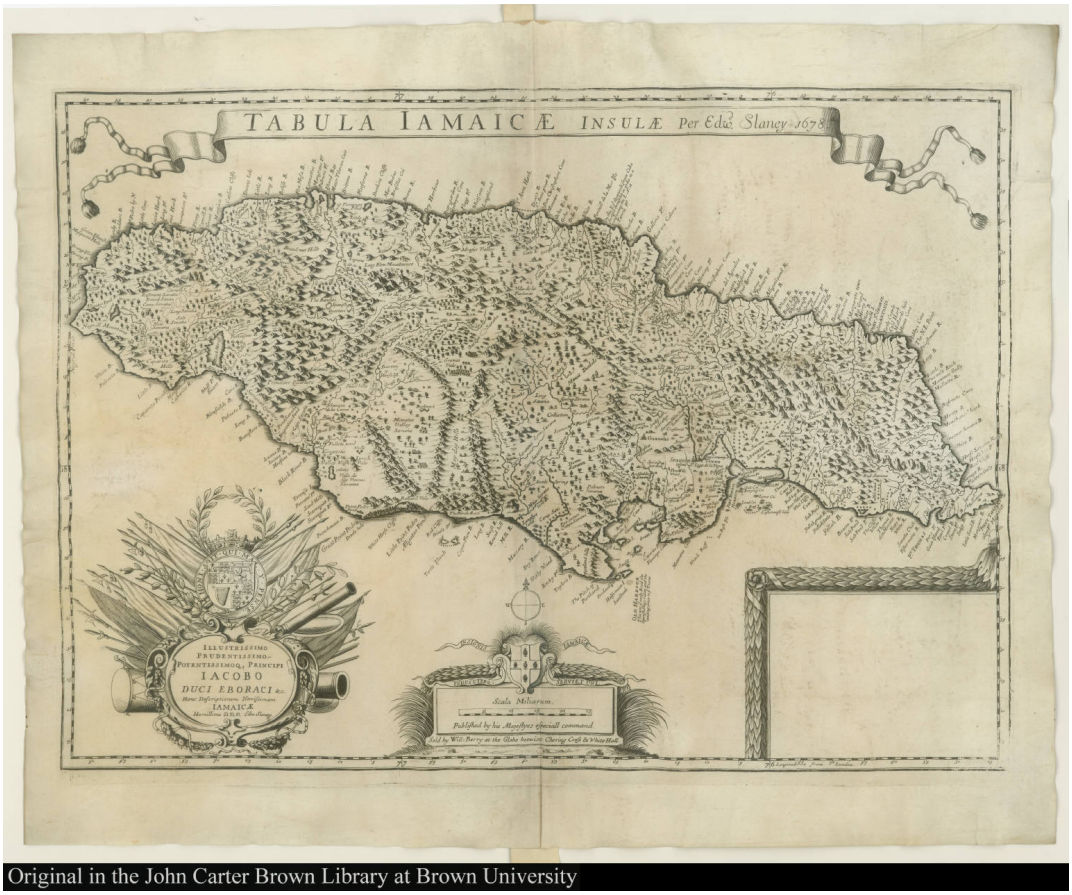
[19] These were *A new map of Virginia, Maryland, Pensilvania, New Jersey, part of New York, and Carolina* published by John Thornton, Robert Morden, and Reeve Williams in 1698, and *A chart of the Cariby Islands* published by John Seller in 1675

of the singular line that made up a coastline. Water depth was indicated with a number, to indicate the 'sounding' level, and the location of rocks were shown with a 'x' for each rock area. These were each individually placed on the paper, and a map that precisely reflected the information in the source it was derived from would require the draftsmen to specifically locate the rock or soundings relative to the coast and land. Sand banks or shoals were indicated by groups of closely-situated dots, usually around the edge of bays or ports. The exception to this were the 'Maine Banck' in Newfoundland and the Bahamas banks north of Cuba.

In contrast with coastal and navigation information, inland topographical information was usually figuratively rather than literally depicted. Interior geography also tended to be generalised as pictures of mountains and trees. Lloyd Brown described how mountains were 'at first were indicated by crude, overlapping lumps […] they all looked alike'.[20] On Edward Slaney's map of Jamaica (1678) the mountains were drawn with repeating 3D images of a mountain, placed over areas of mountainous terrain (figure 52). Although they appear to be plotted, it is difficult to discern further geographical detail from them such as height and gradient. The formidable Blue Mountain range which dominates the central island at over 2000m does not appear different to other hilly regions on Slaney's map. The same representation of mountains was seen on maps of the middle colonies that represented mountain range Appalachians. On Morden and Brown's *New map of the English empire* the Appalachians were depicted with alternating small and larger 3D drawings of mountains, stretching from Cape Canaveral in Florida to Lake Huron in modern-day Canada.[21] A note explained 'on the top of these mountains is a plaine like a terras walk about 200 miles in length'. However, as with the Blue Mountains, the information did not include heights or width of the mountain range, but rather indicated that a series of mountains were located in roughly that region. Robert Morden's map of North America showed detailed shoals and harbours, but forests were not plotted but instead trees were dotted along rivers and around lakes.[22] This contrasts with the assertions of accuracy for navigation information and the attempts to plot rocks and water depths, suggesting that enabling successful arrival to the island and navigation of the coastlines was a greater priority than inland exploration. It also indicates that there was a greater supply of coastal information than geographical information about the topographically-difficult interior. The limited attention to precision and detail was also relatively constant throughout the period. Map interiors did become more populated, but there was not a significant advance in the level of detail such as density of forest or height and exact location of mountains. This suggests that even as greater amounts of interior geographical information was available, the priority of map publishers was not to publish it. Although maps and charts did vary the level of topographical detail, and the visual style of mountains and trees was not uniform, the limited attention to precision and detail indicates that navigation and coastal information was considered most valuable.

[20] Brown, *Story of maps*, p. 175
[21] Morden and Browne, *A new Map of the English Empire in America* (1698)
[22] Morden, *The North West part of America* (1680)

Figure 52: Edward Slaney, *Tabula Jamaicae insulae* (1678)



Original in the John Carter Brown Library at Brown University

Decoration was an opportunity for the publisher to differentiate him or herself in the market. A different cartouche or additional pictorial detail was sometimes the only clear way to distinguish one map from another of the same area, and could therefore enhance publishers' claims to have produce a new map.[23] They often occupied a small area of the image, distinct from the geographical information, and required skill in fine drawing as well as design, such as the cartouche in figure 52. Seventy-nine from a total of 179 items had elaborate cartouche, usually with highly detailed pictorial detail, including people or angels, a maritime scene, coats of arms.[24] This indicates that over half of the maps or charts had no or minimally-decorative cartouches, in comparison to the 130 number that had navigation information, suggesting that draftsmen spent more time and greater allocation of their abilities on drawing geographical and navigation information than on decorative

[23] Although none of the maps in the 179 examined were exact copies of another, some only contained minor additions that are not immediately obvious to the eye

[24] However, 44 items contained no cartouche at all, while 56 had simple cartouches such as a text box with flower decoration. Items without a cartouche usually had no pictorial information. 32 were maps and 12 were charts

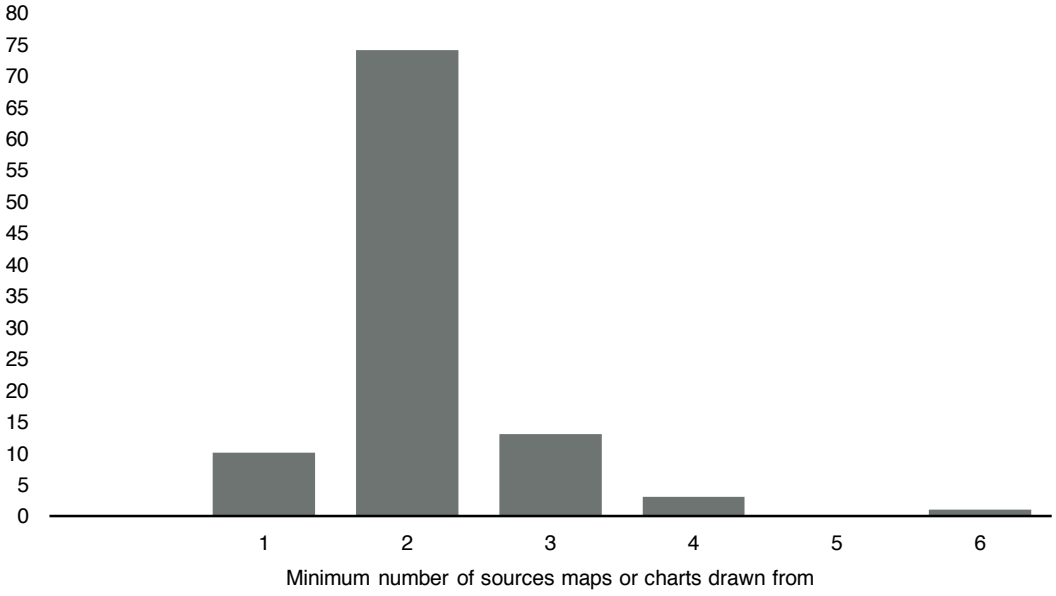
information. Although this was not a simple story of utility replacing decoration through the end of the 17th century into the 18th (some of the most maps with the most dense geographical information also contained very decorative cartouches or insets[25]), the comparative balance of pictorial images to precise geographical information highlights where the pressure for skill lay in cartographic print production.

Cutting and Pasting

Without a centralised geographical survey, supply of manuscript information depended largely on the whims of mariners and settlers. Despite this, a new map or chart was published on average every four months between 1660 and 1720, suggesting that publishers complemented the fragments with other sources.[26] As J.H. Andrews has pointed out, early modern maps were often created from compiled information rather than from a single survey.[27] The fragmentary nature of supply of raw geographical information put pressure on draftsmens' skills, causing them to probably use a 'cutting and pasting' method of drafting. For example, John Thornton used John Narborough's manuscript information about the Straits of Magellan in 1673, but the map included an image of the South American continent which was sourced elsewhere. This required the draftsmen to produce a single image from multiple sources, and rather than being just one possible way of making maps and charts, cutting and pasting appears to have been the dominant method. Historians have derided map makers for copying; however the process of curation, selection, and editing multiple sources to produce a synthesis suggests presence of significant detail rather than reduced skill in the market. Figure 53 shows the results of visual analysis of 101 maps and charts to ascertain the minimum number of sources used in each map.[28] Using visual comparison of sequences of maps of the same geographical area, and identification of repeated publication of graphic motifs or specific geographical information (such as a boundary or place name) across maps, it is possible to estimate the minimum number of sources that a map derived information from.[29] It suggests that to produce almost three quarters of maps and charts, a draftsman worked with at least two sources of information and turned them into a single, coherent image. These sources included printed texts, manuscript information and 'maps from maps' or information from previously published maps. The practice of compiling maps from multiple sources is known to historians. The significance of its impact on draftsman's work process have not been examined, and in the case of maps of the Americas, this practice suggest that it involved significant labour and skill.

[25] Herman Moll and John Senex in particular produced large and densely-detailed maps in the 1700s and 1710s, such as Moll's *A new and exact map of the coast, countries and islands within ye limits of the South Sea Company* (1711) and Senex *New map of the English empire* (1719)
[26] It is also seems that some maps were synthesised entirely from already published sources
[27] Andrews, *Maps in those days,* pp. 355-362
[28] This analysis represents the 101 maps or charts where geographical information was sufficiently detailed to make a judgement regarding number of sources
[29] It uses printed maps and notes by Philip Burden in *The mapping of North America* on the origins of information in maps of North America.

Figure 53: Estimates of number of sources of information used in drafts of 101 new maps and charts of the Americas 1660-1720



Some draftsmen probably had access to manuscript geographical information.[30] In 1676 the Governor of Jamaica sent a ship to London with 'an exact map of the island' in the hands of the Captain, which was partly published in Slaney's map of Jamaica.[31] *Carolina described* used a map of Carolina made by Nicholas Shapley on the *Adventure* c.1665, while a *Map of the whole territory traversed by John Lederer in his three marches* used a map of Maryland and Virginia made by John Lederer between 1670 and 1672, and a manuscript of the Ashley and Cooper rivers in Carolina was printed in *A new description of Carolina by order of Lords Propietors,* 1673.[32] As highlighted earlier, Narborough's drawing of the Straits was partially reproduced by John Thornton.[33]

These sources were complemented with information from previously published maps. In the mid-17th century, these were probably published French or Dutch sources. For example, Robert Walton's map of North America (1658) combined cartography from a map published by Pieter van den Keere issued by Visscher and from a map published by Blaeu in 1648.[34] Although use of Dutch and French sources did not disappear (George Willdey used maps by Guillaume de I'sle in a map of North America published in 1709), the use of English sources by English publishers increased significantly. This was particularly so for colonies such as Barbados,

[30] The nature of these relationship is unknown, including how exactly a publisher procured the manuscript material. However the limited copyright on maps and charts meant that newly-drawn geographical information was quickly reproduced by other publishers, and thus a publisher who had access to primary data had only a small period of time during which he or she had an advantage over other publishers in terms of novelty of information
[31] Governor Lord Vaughan to Sir Robert Southwell April 4 1676, Calendar of State Papers: Colonial, Vol. XXXVI, No. 42 (The National Archives, London)
[32] Thomas D. Wilson, *The Ashley Cooper plan: the founding of Carolina and the origins of Southern political culture* (Columbia, S.C., 2016), p. 146
[33] John Thornton, *A mapp of the Magellan Straights* (1673)
[34] Burden, *Mapping of North America*, p. 43

Jamaica or South Carolina where English publishers dominated the trade. Even in cases where a publisher produced a map that represented a significant break from earlier representations, for example the Edward Slaney map of Jamaica published in 1678, the new design was quickly used by other publishers in their own maps and charts, effectively causing an 'update' in graphic information across the market. Efforts to create copyright regimes for particular publishers (John Seller claimed that the content of his maps were protected by a Royal proclamation) were mostly ineffective, and publishers and draftsmen were essentially free to borrow information and designs from other maps. The low cost of printed maps (many cost just 1s) meant that it was cheap for publishers to buy other publishers work. The barriers to copying were low and the incentive to produce new items high. One example was the cartography of Virginia produced by John Lederer on his voyages in Virginia. Lederer's observations were printed in a small map of the mid-Atlantic region in 1672.[35] The same graphic design of Virginia was reproduced on at least seven further maps printed in London between 1672 and 1695, on three separate maps sold by John Seller, John Ogilby and John Thornton all in 1673, a map of Carolina published by Bassett and Chiswell in 1676, a map of North America by Philip Lea in 1684, a map of the English Atlantic empire by Herman Moll in 1695, and John Senex *A New Map of America from the Latest Observations* in 1719.[36] These maps covered different geographical regions and were different sizes, but in each case the publisher and draftsmen had selected the cartography from John Lederer's description of Virginia and reproduced it within distinct and different geographical pictures. Gavin Hollis writes that Lederer's influence on English cartography 'did not last long', implying that the Lederer cartography was relatively insignificant.[37] In fact, Lederer's cartography acted as a new graphic entry in the map market, effectively replacing earlier views of Virginia and some subsequent publications of maps of North America used William Talbot's printed view to incorporate the design into their own map.[38] Rather than printed maps and charts acting as single objects within a market, they had longer life-spans as elements of them were incorporated into other subsequently published items.

What were the implications of this cutting and pasting on a draftsman's workflow? There are no sources describing a map-maker's work process, but it is possible to imagine a draftsman at a desk bent over three or four different printed maps, with a brief from the publisher to draw a map of the North American continent. Perhaps he or she was also given a manuscript drawing sent by a colonist on a ship recently arrived in London. With a blank piece of paper and a pencil, the draftsmen faced the task of drawing an image of North

[35] John Lederer, *The discoveries of John Lederer, in three several marches from Virginia to the West of Carolina* (1650)
[36] John Seller, *A chart of the West Indies from Cape Cod to River Oronoque* (1673); Ogilby, *A new description of Carolina by order of Lords Proprietors* (1673); Thornton, *A new map of North part of America* (1673); Bassett and Chiswell, *A new description of Carolina,* in a newly engraved edition of *John Speed prospect of the most famous parts of the world* (1676); Lea, *North America divided into its principal parts* (1684); Moll, *A map of English plantations* (1695)
[37] Gavin Hollis, 'The wrong side of the map?: the cartographic encounters of John Lederer' in ed. Martin Bruckner, *Early American cartographies,* pp.145-168
[38] This fragmented, horizontal dispersal of geographical information is not always as easily traced as in the Lederer cartography - where the certainty of the original survey and the novelty of the information due to Carolina's fledging status as a European colony make tracing the genesis of the graphic design relatively simple

America that combined all the geographical updates available, by selecting elements of each map and drawing a new one. This drawing process was probably relatively easy in cases where the draftsmen could directly trace an image from the source, for example from another printed map or a manuscript drawing. One manual suggested eight ways 'to take the perfect draft from any picture', including applying oil to paper to make it transparent, placing it on top of the image, and tracing the lines through the paper.[39] The apparent low cost (the material required in these eight suggestions varied between oil and butter to a swallow's feather or raven's quill) and simplicity of the methods (none required the use of specialist technology or skills beyond those that a draftsman probably already had) indicates that they were probably to be used by modest artisans. However, this method only applied in so far as the desired map image was the same size and scale as the material it would be taken from. Any variation in size and scale of the original image required a re-drawing to produce a new image. There was significant variation in the size of printed maps, even in cases where the geographical information was largely the same on two separately printed maps. In 1683 John Thornton published a chart of the Atlantic including Newfoundland coasts, based on a map published five years earlier.[40] It reduced the 1678 map from a four sheet map to two sheets but contained the same geographical coverage with the exception of extending slightly further north to Hudson Bay. In this case, although the draftsman had an image template to work from, but the decrease in size of the map required the draftsman to re-draw and re-scale the image in order to maintain coherency.

Similarly, in cases where a publisher used a French or Dutch design as the basis for their own map or chart, the nomenclature was usually changed into English, which required the work of a draftsman to change the place names and language used in the title. Robert Walton published a map in 1658 that he promised was 'a new plaine and exact map of America, described by N I Visscher, and done into English, enlarged and Corrected'.[41] Although translation was simple, names in another language varied in length, requiring a draftsman to re-position and re-draw information. Philip Burden identifies that Joseph Moxon used a Dutch map made in 1652 to produce *American septentrionalis* in 1664, using similar outlines and levels of geographical detail, particularly in the Gulf of Mexico. However, places names were altered, including 'Nova Anglia' to 'New England', and in New England Moxon added 30 names to the four named on the original, including New York for the first time (see figures 54 and 55).[42] This required the draftsman to plot new names and the space on the map devoted to New England was expanded, altering the eco-system of the whole map. This process of name changing did not take place for each map. On a map of America published in 1681 by Jonas Moore, but derived

[39] Albrecht Durer, *A book of drawing, limning, washing or coloring of maps and prints London : printed by M. Simmons, for Thomas Jenner* (1652), pp. 18-19. Advice to use oiled paper in the transfer of images also appeared in Salmon *Polygraphice* (1673), p. 42

[40] John Thornton, *A new and exact chart containing the sea coasts of Europe, Africa and America* (1678); Thornton, *A chart of the sea coasts of Europe, Africa, and America* (1683)

[41] Walton, *A new plaine and exact map of America* (1658)

[42] Philip Burden identifies that Moxon's map was derived from a map by Theunis Jacobsz. I have not been able to identify this, but a map entitled *America septentrionalis* was published by Jan Jansson that contains clearly similar detail to Moxon's. Moxon's residence in Amsterdam further suggests that he had access to Dutch maps

from a map by Pierre Duval in 1672, some names were changed to English (N England, Maryland, Great Bank Newfoundland), but others remained in French and Spanish (Virginie, Spaine, Castille Dor, Bresil, La Plata, La Conception).

Figure 54: New England detail from Jan Jansson, *America septentrionalis* (Amsterdam, 1651)
Reproduced with permission from Library of Congress, Washington D.C

Figure 55: New England detail on Joseph Moxon, *America septentrionalis* (1664)
Reproduced with permission of The New York Public Library

In addition to working from images, draftsmen also probably used published texts to inform graphic geographies of the colonies. In many cases, textual descriptions were published before maps were available of a new colony, or the first maps were so graphically simple that in comparison textual descriptions gave a much richer geographical impression of the place. Some settlers expressed the majority of their observations in text rather than in visual format - Hans Sloane wrote a geographical description of Jamaica, with one small old map of the island. Due to their richness and detail, it certainly seems probable that geographical texts would have been a productive source for draftsmen to mine. Philip Burden has suggested that the mention of *Spaw Sachem* in Morden and Berry's map of New England (1676) was drawn from the printed account of Kings Philip's war *The Present State of New England with respect to the Indian War* (1676), because no other source this early refers to Spaw Sachem.[43] Other clues regarding the relationship between printed text and maps include John Seller's publication of the first detailed chart of the Windward Passage straits in the Caribbean sea in 1675, three years after Richard Blome published a new geography of Jamaica.[44] Blome described the island as 'betwixt the

[43] Burden, *Maps of North America*
[44] Blome, *A description of Jamaica,* (1672). Edmund Hickeringill had also described the position of Jamaica as between the 17 and 18 latitude in his account of Jamaica printed in 1661. Hickeringill, *Jamaica viewed* (1661)

Tropicks in the 17. and 18. Degrees of Northern Latitude; and beareth from off the island of Hispaniola Eastward, about 35. leagues. From the island of Cuba Northwards, about 20. leagues'.[45] Seller's chart reproduced these bearings and locations, although the chart included islands not described by Blome, suggesting that the draftsmen used other sources. Many geographical texts were sold by map publishers, suggesting an easy transfer of information to a draftsman, or perhaps it also inspired the publisher to make a new map.

This assessment has shown that drawing maps of Americas involved a complex array of skills and decisions by a draftsman, partly created by the fragmented flow of geographical information from the American colonies. The most exercised aspect of drawing was in precision and focussed drawing of navigation and coastal information, rather than decorative information, and the ability of the draftsman to produce a representative drawing determined the appearance of the colonies to the eventual map viewer. Draftsmen probably had to use processes of 'cutting and pasting' in order to compile new graphic representations of geography, using multiple sources, and the practice of taking information from previously printed maps or texts was more challenging to a draftsman than producing an image from a single manuscript survey. Drawing quality was intimately linked to engraving, which was the next stage in the process of map production, as highlighted by John Evelyn who wrote that it was 'an absolute requisite to that of chalcography'.[46]

Engraving

Although art historians such as Anthony Griffiths acknowledge the centrality of engraving to early modern print production, historians of cartography are largely skeptical about English engravers' skills.[47] Helen Wallis writes 'many of the products of the printing trade were poor quality and plagiarism was rife', citing the example of William Berry using maps by French publisher Sansson and John Seller's use of Dutch plates.[48] Wallis does not elaborate on the criteria she uses to judge their output, but it is appears to be based on the originality of the cartographic information and the aesthetic quality of the images. Historians also tend to focus on the practices of copper-plate re-usage. Sarah Tyacke writes, 'it is often possible to find a sequence of maps, all in different states, pulled from the same plate over a period of years, indicating quite clearly the common practice of map-sellers of purchasing old copperplates, revising and selling them over a number of years'[49]. The implied conclusion of this argument is that this was an inferior method of producing maps and charts, involving less skill and finesse than producing new plates. The practice of 'revising and selling' copperplates is asserted to be simplistic and almost lazy. Lawrence Worms writes that John Seller 'acquired quantities of disused Dutch

[45] Seller, *The windward passage from Jamaica betweene the East End of Cuba and the West End of Hispaniola* (1675). Blome, *A description of the island of Jamaica* (1672)
[46] Evelyn, *Sculptura,* p. 105
[47] Anthony Griffiths, *Prints and printmaking: an introduction to the history and techniques* (Berkeley, 2006), p. 38
[48] Wallis, Helen, 'Geographie is better than divinitie: maps, globes and geography in the days of Samuel Pepys', in ed. Norman J Thrower, *The compleat plattmaker: essays on chart, map and globe making in England in the 17th and 18th centuries* (1978) pp. 1-42
[49] Tyacke, 'London map-sellers', p. 64

printing plates […] and simply refurbished them for use'.[50] Worms considers this practice of 'refurbishing' as an indication of artisanal failure. According to this interpretation, English map production was undeveloped and unsophisticated, incapable of innovation or originality.

However, this assessment underestimates the scope of labour and skill involved in re-working a plate, including the work required to introduce different nomenclature, a change of language, different geographical information, or altered decorative information. It also overestimates the number of maps published from plates with just minor alterations. This chapter shows that analysis of 176 published maps and charts indicate that 95% were probably published from plates that were either new (when displaying a new graphic design of a space) or had required significant re-working (when displaying significant changes to previously published images of the same space). Historians tend to argue that the reason for the lack of updated information on English maps is because the cost of purchasing and engraving a copper plate was too high for publishers to invest in - but evidence of re-engraving on maps and the probably number of new or significantly re-worked plates suggests that some publishers were willing to invest in engraving plates.

Engraving was the second step in the map production process and was arguably the most instrumental in determining the final appearance of the map. An engraver's skill in accurately transferring the draft onto the copper plate defined the quality of the map image, and in turn the graphic understanding of empire achieved by viewers of the map. Quality of engraving here is defined as the fidelity of the engraving to the raw geographical information, rather than measured by the aesthetic appeal or the finesse of the lines as usually defined by art historians. The centrality of the engraver's work was highlighted by publisher Braddock Mead, who wrote that 'for want of encouragement, chart as well as mapmaking, is fallen into the hands of the engravers, whose skills consists in supplying the print-sellers with their productions in the most expeditious manner and at the lowest rates'.

Once an image was prepared, an engraver engraved the drawing into a plate made of thin copper.[51] Ink was then spread over the surface of the plate, which was run through a printing press. The size of the plate was limited by the size of rolling print presses. However, as figure 3 demonstrates, size of printed maps and charts of the Americas varied significantly, indicating that engravers worked with many sizes of plate. A publisher was unlikely to sanction the waste of copper, so it seems certain that plates were cut to purpose for engraving. If the size of the map exceeded the size of a single plate, multiple plates were engraved and the item was printed in multiple separate sheets. These sheets could be sold as separate individual maps or joined to be sold as a single item. This was the case in 1698 when John Thornton sold *A New Map of Virginia, Maryland,*

[50] Lawrence Worms, 'Maps and Atlases' pp. 228-245 in eds. John Barnard and D.F McKenzie, *The Cambridge history of the book: volume 4 1557-1695* (Cambridge, 2002), p. 242

[51] By the mid-17th century, engraving had been an integral part of image production and circulation in Europe for 200 years

Pensilvania, New Jersey as a single map in four sheets.[52] He also published a chart of Newfoundland that was sold as two separate maps, with different titles, but when put together the coastlines aligned to create a more expansive geographical view of the region.[53] These practices demonstrate the limitations placed on geographical information production by material conditions, such as copper plate size and printing press size, as well as strategies used by publishers to adapt their commercial practices to exploit these conditions.

Detailed instructions in manuals indicate that copper plate engraving was complicated and laborious.[54] The plate surface had to be smooth before engraving otherwise marks or indentations would show on the final paper image. Once the engraver had removed flaws from the surface, a layer of wax was spread across the surface to aid the tracing of the drawing onto the plate enabling the engraver to make a more accurate reproduction of the image. The engraver traced the lines of the image into the wax. Engraver William Faithorne advised, 'Put your plate upon the fire and let it heat a little, then take a piece of whitest virgin-wax and spread it thin over the plate, and with a smooth feather gently stroak it all over; to the end it may lie the more even and smooth; then let it cool'.[55] Faithorne also suggested a method specifically for copying a 'printed picture' i.e., an already published image - to place the print down onto the plate and rub the image onto the wax using a burnisher, which would create an imprint of the image.[56] A small chisel or burin was used to scrape the lines of the image into the plate. A burin had a round head and pointed, sharp end, which pressed at an angle into the surface to remove thin strips of copper. One manual advised that in the case of maps, a 'strait graver is the most commodious'.[57] Deeper grooves in the plate produced thicker lines on the image as the groove would collect more ink, whilst shallower grooves made thinner lines. Rather than moving the burin across the plate, the plate was placed on a cushion which was rotated and tilted away from the engraver to pull the burin along the surface.[58] This gave the engraver greater control and, it was hoped, would make a smooth and continuous line. To remove errors, it was recommended to use a burnisher 'to rub out the scratches' and engravers were advised to rub charcoal over the plate 'to take off the Barb or Harshness of your work, without which you can never take off a good print'.[59] Similarly, 'a piece of bevor or castor' was advised to be dipped in oil and rubbed on the plate 'by which you may better discover your work as you do it'.[60] These tools were probably to have been relatively low cost, due to their simple design and materials. One manual advised engravers that they could

[52] Thornton, *A new map of Virginia, Maryland, Pensilvania, New Jersey* (1672)
[53] Thornton, *A new chart for the seacoasts of Newfoundland* and a *Chart of the north part of America* (1677)
[54] Evelyn, *Sculptura*; William Faithorne, *The art of graveing and etching* (1662)
[55] Faithorne, *The art of graveing*
[56] Ibid, p. 40
[57] *The English academy* (1672)
[58] *Albert Durer revived: or, a book of drawing, limning, washing or colouring maps and prints* (1698)
[59] Ibid
[60] *The English academy*

buy an oyl-stone and graver from 'several shops' in Foster Lane, Cheapside in London, and in 1660 the Royal Society paid 3s in 1660 for an oyl-stone.[61]

If the final printed map was to be the same as the draft image, the engraved lines had to match those on the drawing. John Evelyn wrote that the main task of an engraver when copying a design was 'to render it correct both in relation to the Draught, Contours and other particularities, as to the Lights and Shades on the Front, flying or turning, in bold, or faint touches; so as may best express the relief.'[62] One example highlights how much information one engraver, James Moxon, had to engrave. John Ogilby's *A new description of Carolina* (1673) included two elaborate cartouches, 58 mountains, rivers and coastlines with topography, soundings, and 144 places names. One cartouche showed two figures standing next to a tree and sitting on branch, with a fur at their feet, and another of eight people standing around a waterfall and a tree-lined lake. Some detail was achieved with speckled dots and others with lines, requiring different application of tools by Moxon. 58 mountains were drawn to indicate the Appalachians mountains, and rivers and coastlines were shown with continuous lines. 20 trees were drawn with lines and individual marks. Two deserts were shown with dotted detail through out. 'The Apalathean mountains' and 'Carolina' were written in large letters, as well as 144 place names, which each required individual engraving. Other detail included margins around the edge; scale of English miles; inset with a branch drawn around it, and inside the Ashley and Cooper rivers, with 8 soundings and five shoals with speckled detail. Engraving this map required the application of many different strokes and depth of mark, requiring focussed and precise attention to detail. If an engraver made a mistake or had to change a section, they first had to flatten the plate in order to remove previously engraved lines – this involved removing the top layer of copper to the depth that lines had been engraved at (this was often deep in order to ensure that the ink collected sufficiently in the grooves in order to transfer well on to paper). Once a flat surface was created, the new image could be engraved onto the surface.

Who were map engravers?

Some publishers were also engravers, such as James Moxon, who published several maps of the Atlantic including a map of Jamaica in 1677. He engraved for at least two publishers, including on John Ogilby's *America.* However evidence from publisher George Willdey's account books suggest that some publishers hired engravers.[63] Willdey paid engraver Emmanuel Bowen £3. 10s for 'graving the harbours in the map of France' in 1717, perhaps hiring him just to engrave that section of the plate.[64] Robert Walton also did not engrave his maps and complained in 1659 that the poor quality of his engravers work was slowing down his publication

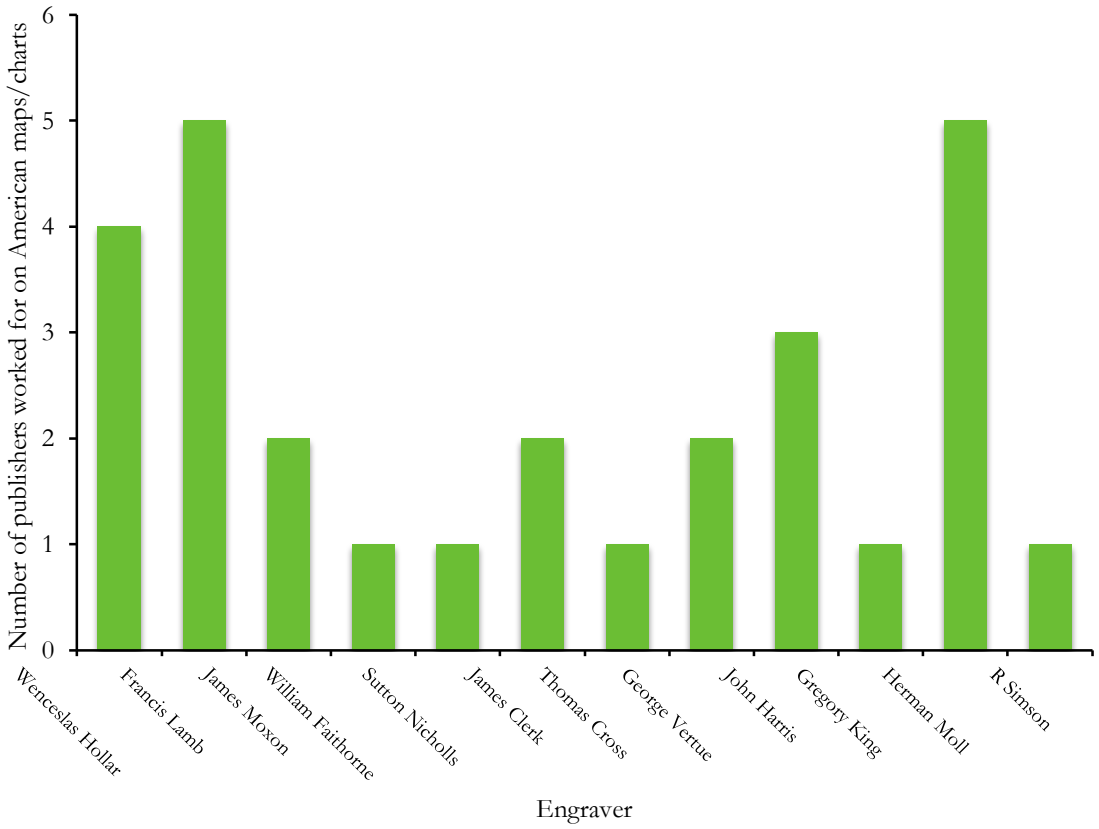
[61] Royal Society account books, Royal Society, London AB/1/1/1
[62] Evelyn, *Sculptura,* p. 119
[63] George Willdey account book O, C104/21, TNA.
[64] Ibid

rate - he claimed he had 'many other, both sheets and half sheets (and is doing more) and had not the graver been backwards, more had been made known of the world before this time'.[65] Publisher William Dugdale paid his engravers, including Wenceslas Hollar, per plate. An engraver called Faithorne, who seems probably to have been William Faithorne, also supplied plates to William Dugdale.[66] Surveyor Augustine Hermann and publisher Thomas Withinbrook also employed an engraver called Faithorne to engrave their map of Virginia and Maryland published in 1673.

Figure 56 highlights the number of different publishers of American maps that engravers worked for London, as indicated by signatures on maps. It shows that of the 12 engravers who included their signatures on maps, seven worked for more than one publisher, including up to five publishers. Francis Lamb and Herman Moll (who himself became a publisher) both engraved maps of the Americas for five different publishers. It also highlights that publishers hired a variety of engravers to work on maps. There was no correlation between the type of geographical area covered in a map and the engravers employed, indicating that engravers were not selected due to their geographical expertise. It seems probably that publishers chose engravers according to prior working experience with them, the availability of the engravers, and the labour costs of the engraver. This data does not include cases where engravers did not sign their maps, and so the probably number of engravers employed by publishers is higher. Employment of multiple engravers by one publisher indicates that publishers had surplus work for just one engraver to manage at a single time, probably due to the labour-intensive nature of engraving, and it also suggests that publishers were producing several maps concurrently. Faithorne's employment by several different publishers indicates that engravers were not bound to work for single publishers and worked essentially 'freelance'.

[65] Robert Walton, *A catalogue of some pleasant and useful maps*, c.1659, E.1863.(2) BL
[66] Anthony Griffiths, *The print in Stuart Britain 1603-1689* (1998)

Figure 56: Engravers and publishers in London 1660-20



The profile of one engraver, William Faithorne, suggests that engravers involved in producing maps of the Americas had significant skills and experience in technical, mathematical and decorative print production. His portfolio indicates that he was an accomplished artisan with experience in engraving detailed and respected maps. He is acknowledged as the engraver on a number of prints, portraits, as well as on a map of London published by Richard Newcourt in 1658.[67] *Exact Delineation of the cities of London and Westminster and the suburbs* was a large and finely detailed plan view of London, including 121 houses drawn along Fleet Street alone, from Ludgate Circus to Lincoln's Inn, a lengthways distance of 22cm on paper.[68] The map also shows a table listing a total of 127 churches, each with a corresponding number on the building in the map. Faithorne was clearly a skilled and experienced map engraver able to engrave minute and complicated detail with consistency to produce a large and dense drawing. He engraved a map of Virginia and Maryland sold in 1673 by John Seller.[69] It showed the Chesapeake Bay, with finely detailed coastlines including shoals, water depths and rivers. It also

[67] Richard Newcourt, *Exact delineation of the cities of London and Westminster and the suburbs* (1658), 1977 Folio edition, *Folio 104,* Beinecke Library, Yale University
[68] Ibid
[69] Seller, *Virginia and Maryland* (1682)

included a complex cartouche and a portrait of surveyor Augustine Herman, who had produced manuscript information about the region. His work engraving both the map of London and of the middle colonies indicates that an engraver did not require special skills to engrave a colonial map, but instead their skill in fine and precision drawing was most significant. It indicates that labour for colonial maps was drawn from the small pool of artisans that existed for the rest of the publishing and engraving trade, and conversely that imperial trade provided labour for the broad printing artisanal community. Later he worked for the Royal Society, who made a payment of £1 to 'Mr Faithorne' for engraving a plate in 1686.[70] Additionally he engraved a large number of prints and portraits, including an elaborate portrait of Oliver Cromwell in 1658, and after the Restoration was appointed 'engraver to copper' to the King Charles II.[71] He also translated and published Abraham Bosse's *Art of Engraveing* in 1662. During his career, he took on nine apprentices.[72] But Faithorne's prolificacy did not make him immune to criticism - Augustine Herman, the surveyor who collected some of the information for the map of Virginia and Maryland, commented that it had been 'slobbered over by the engraver Faithorne defiling the prints by many errors'.[73] His comments highlight the central role of the engraver in creating the images of British colonies on maps and charts, and the pivotal role of their skill and quality of engraving. Although Faithorne is just one example of an engraver, the pluralistic nature of map publishers' business, the similarity of colonial map engraving skills to other maps as well as prints and portraits, and the dominance of skills of precision and technical drawing over familiarity with colonial geography all suggest that the burden of labour and skill for producing visual understandings of the empire lay with artisans who were not experts in colonial cartography but were experienced practitioners.

Costs

The costs of engraving are fodder in a debate by historians about publishers' practice of refurbishing old copper plates. Sarah Tyacke listed some engraving costs and concluded that 'the copper-plate and its engraving seems to have been by far the most expensive items a map-seller incurred'.[74] This analysis is part of historians' conclusion that artisans reworked plates, instead of producing new maps, in order to avoid the higher costs of purchasing and engraving a new copper plate. However this does not factor in the labour involved in re-working a plate, which the following analysis of engraving costs and map design suggests was significant, due to numerous changes in map design and therefore requisite plate design. This suggests that re-working a plate was expensive, and questions whether it really was used as a strategy by publishers to save money. The analysis suggests that publishers were willing to pay the costs of significant plate re-engraving, or even engraving of new

[70] Royal Society account books, AB/1/1/2 – 1672-1682 Royal Society, London.
[71] The National Portrait Gallery, London lists 716 engraved portraits associated with Faithorne http://www.npg.org.uk/collections/search/person/mp01525/william-faithorne?role=art accessed 8th February 2016; Anthony Griffiths, *The print;* Anthony Griffiths, "The print in Stuart Britain' revisited' in *Print Quarterly* XVII (2000) pp. 115-122
[72] Griffiths, "The Print" p. 118
[73] Burden, *Mapping of North America Volume 2*, p. 29
[74] Tyacke, *London map-sellers*

copper plates. Evidence for costs of copper plates and engraving labour is fragmentary. Costs of engraving varied according to the size of the map and density of information included in the design – the larger and more dense a map was, the longer it would take to engrave, and therefore the higher the labour cost to the publisher.

Buying copper to make a plate cost less than the engraving labour. Plates were priced by weight. In 1653, William Faithorne sold William Dugdale three blank copperplates weighing 9bl 13oz. for £1.19s.6d, with the rate of 4s per pound. A surviving copper-plate in the National Library of Scotland from a book frontispiece in the Company of Darien papers can be used to estimate the cost of a copper plate in 1653.[75] The plate weighs 715g or 1.57 pounds and measures 30x20cm, with a surface area of 600cm^2, and according to 1653 prices would have been 4s.6d. A 'Plat of all the world' published by Joseph Moxon in 1657 measured 530x780cm, or 41340cm^2, would have required a plate that cost around £15.8s. However 530x780cm was large in comparison to most maps. A more common size was 380mmx500mm, with a surface area of 19000cm^2, used in Bassett and Chiswell's map of Virginia and Maryland published in 1675. The cost of a plate to produce this map size would have been £7.2s. This correlates with evidence cited by Sarah Tyacke, which claims that Robert Morden may have paid 12s.9d for a piece of copper that was 35cmx43cm in the 1690s, and evidence that in London in 1680 the price 'of copperplates, ready planish'd for etching uppon was 3s per pound'.[76] According to the calculations using the NLS plate and the copper price in 1653, the cost would have been 11s.5d. On the other hand, an inventory from Philip Lea's shop in 1700 revealed that he had 'sixteen hundred weight of copper' valued at 18d per pound, significantly less than the 4s per pound in 1653., however this could be explained by depreciation of the copper. The high amount of copper in Philip Lea's shop suggests he had significant capacity to buy copper.

The main cost was paying the engraver for labour. Labour costs varied according to the density of the map design; the more hours that an engraver spent engraving the plate, the higher the labour costs to the publisher. Anthony Griffiths claimed that William Dugdale paid his engravers, which included Hollar, an average of £1.6s.8d per plate, which could rise to £3 or £5 for a complicated plate. It is not clear what constituted a complicated plate, and certainly the majority of maps of the Americas contained dense detail. John Evelyn recorded that William Petty paid £1000 to have his 36-sheet map of Ireland engraved in Amsterdam, or just over £27 per sheet (as indicated earlier, plate size was limited by the size of printing presses).[77] This cost is between 5 and 9 times higher than the £3 or £5 suggested by Griffiths. It is possible that engraving costs were higher in Amsterdam due to the greater expertise in engraving present in the city; on the other hand, there were probably more engravers living in Amsterdam which would have reduced the cost of labour due to supply

[75] Company of Scotland papers MS83.6.3, NLS
[76] Letter from David Loggan to Mr Croxall, Stowe MS 746.f.26, BL
[77] E.S de Beer, *Diary of John Evelyn*, (1959)

of workers. Although it was very large, William Petty's map of Ireland was not more complicated in design and content than the majority of maps of the Americas, suggesting that the cost of engraving maps of the Americas would not have been significantly different.[78] George Willdey listed payments made to engraver Emmanuel Bowen in the 1710s. In 1716 he paid £15. 18s for engraving four plates for two maps. The cost per plate in this case was just under £4. In 1718 he paid £18 for the engraving of his 'large map of the world', consisting of 28 plates.[79] Between February 1715 and 1718, Willdey paid Emmanuel Bowen £149. 8s. 23d for engraving 19 maps.[80]

Another estimate of engraving costs comes from drawings made by surveyor John Slezer for his *Theatrum Scotiae* in 1693.[81] The drawings were each sized roughly 46 x 36cm, which was roughly the same as the median size (39.5cm x 50cm) of maps and charts of the Americas. Some of the drawings, including *The Prospect of ye Town of Inverness*, contained similar levels of detail detail to the insets and cartouche drawn on maps and charts such as Herman Moll's map for the South Sea Company or map of Barbados, indicating that similar skills and time were required from an engraver. The drawings were sent from Scotland to London (indicating that engraving skill in London was preferred to Edinburgh) and Robert White was paid to engrave them at £4.10s per plate, around the same as Hollar's fees.

Figure 57: Estimated hours engraving labour per map according to Wenceslaus Hollar hourly fee (12d)

Engraver	**Items**	**Cost**	**Hours (at 12d per hour, charged by Wenceslaus Hollar)**
George Willdey to Engraver Emmanuel Bowen	Four plates for a map of France and a map of Spain and Portugal	£15.18s	318
George Willdey to Engraver Emmanuel Bowen	Map of the World (28 plates)	£18	360
George Willdey to Engraver Emmanuel Bowen	All payments 1715-18	£149.8s	2988
George Willdey to Engraver Emmanuel Bowen	Two-sheet Map North America	£20	400
William Dugdale to Wenceslaus Hollar	Average per plate	£1.6s.8d	26

[78] Griffiths, 'The Print', p. 120
[79] George Willdey account book O
[80] Ibid
[81] John Slezer, *Theatrum Scotiae* (1693)

William Dugdale to Wenceslaus Hollar	'Complicated plate'	£5	100
Peter Stent to Wenceslaus Hollar	View of Greenwich (Hollar claimed should be minimum £10 payment)	£10	200

How many hours of engraving labour did the market provide? Francis Plate described Wenceslas Hollar's working habits in London, who he claimed 'did all by the hour in which he was very exact for it anybody came in that kept him away from business he always laid ye hour glass on one side till they were gone. He always received 12d an hour.' If Hollar charged 12d per hour, and claimed that the View of Greenwich should have received minimum £10, it suggests that he spent 200 hours working on the engraving (figure 57). If other engravers such as Emmanuel Bowen (working for George Willdey) charged a similar per hour amount (12d), it would mean that the two-sheet map of North America that received a final payment of £20 would have taken 400 hours to engrave. At eight hours working a day, this would take 50 days or almost two months to produce two plates for one map, if engraver worked every day of the week and without working on anything else. Figure 8 highlights the number of labour hours required for engraving maps according to the hourly fee charged by Hollar. It indicates that according to Willdey's accounts, the total amount of work provided by Willdey to Emmanuel Bowen amounted to 2988 hours, or 373.5 days of working eight hours each day of the week. This indicates that Willdey alone provided Bowen with probably at least 1.5 years of work. Furthermore, Hollar's skill in engraving and reputation as an artist may suggest he was able to charge more than an average engraver, meaning that for an average engraver the time spent engraving may have been even longer. This highlights the lengthy process of engraving a map plate, and the significant labour contributed by artisans to mapping the empire.

Engravers were not always guaranteed to receive a wage they felt they deserved, according to Francis Plate. He wrote that publisher Peter Stent did not treat Hollar fairly - 'Old Peter Stent made an advantage [of Hollar's extreme want] purchasing several of his plates for a trifle. He told me he [Stent] gave him but 30 shillings for the Long View of Greenwich which very well deserved ten or fifteen pounds'. This would seem to contradict that statement from Braddick that the map trade was in the hands of engravers, and instead suggests that publishers were able to pay whatever they felt like. However, a wage difference of over £14 for one engraved plate does suggest that Hollar or Plate were exaggerating. It may be the case that Hollar felt he deserved a higher wage because he was a recognised artist as well as engraver, but Peter Stent did not recognise this in his payment.

The high cost of engraving labour and the hours required for engravers to work in order to produce maps suggest that even the practice of re-engraving a plate was a significant investment of capital for a publisher and of labour for an engraver. There has been no attempt by historians to systematically analyse map and chart

production in this period to estimate the number of new or re-engraved plates that were produced. Without publishers' account books, it is difficult to do this with precision. However analysis of chronological sequences of extant maps and charts of the same geographical area can suggest the scope of changes between maps, thereby giving an estimate of whether the change was significant enough to require engraving work, including a re-surfaced plate.[82] Although this does not provide the exact evidence that publishers' accounts would, it can suggest that scope of labour used in producing these maps and charts. It is not possible to distinguish between cases when a new plate was bought and cases where an old plate was entirely re-surfaced, although the costs were not probably to have been significantly different due to the burden of cost lying with engraving labour rather than purchasing the copper. Figure 58 shows results of analysis of 176 first edition maps and charts. It indicates that an estimated 165 required the production of a new copper plate or a re-engraved plate in order to produce the image. This was in 95% of publications. The factors identified that suggest a map cannot have been reproduced from a previous copper plate without significant work to a plate or a new plate are a change of map size; change in scale; introduction of rhumb lines across the map; and significant change in geographical information such as re-drawing of a coastline (particularly so for maps of Jamaica and Barbados). For example, in 1683 John Thornton published a chart of the Atlantic including Newfoundland coasts, based on a map published five years earlier.[83] As stated earlier, it reduced the 1678 map from a four sheet map to two sheets but contained the same geographical coverage with the exception of extending slightly further north to Hudson Bay. Although the information was largely the same, the reduction to two plates will have required engraving a new image, either on a new plate or refurbishing an old plate, the second of which required additional engraving labour. Another example is in Richard Blome's map of America (1669) which he stated was based on Jan Sansson's *American Septentrionalis* but was 'rendered into English and illustrated by Richard Blome' (figures 59 and 60). [84] Although they appear similar in appearance, Blome's map contains different geographical information to Sansson's map in Newfoundland, the middle colonies, and Maryland. Crucially place names such as 'Golphe de S Laurens' are changed to English 'Gulph of St Laurenes', and the size and positioning of lettering 'American Septentrionalis' across the middle is different, as well as the cartouche. It is highly unlikely that even if Blome had access to Sansson's plates, that the required changes could have been made without damaging the plate. Furthermore, engraving labour would have been required in either case to produce the new parts of the image. This suggests that for Blome producing the map required significant investment in engraving

[82] Publishers could theoretically have used other publishers' plates to introduce changes to map designs, however this practice seems unlikely due to commercial nature of the market. Unless a publisher died and sold his or her stock, or entered into a partnership included shared ownership or inheritance of plates (all of which were not uncommon but not universal), a publisher would not have had access to another publisher's plates. It also does not seem to make sense that a publisher would sell his or her own plates to another – even if did not want to make another run of prints, if re-furbishing was so common, the publisher would probably re-engrave his or her own plate instead of selling it – unless they were forced to by death or bankruptcy. The close timing of maps of similar appearance to each other and the timing of bankruptcies of publishers does not suggest that many publishers had easy access to other publishers copper plates Therefore, even in cases where maps or charts had very similar geographical content, a new plate was highly probably to have been engraved if the publisher did not have access to already engraved plates

[83] Thorton, *A new and exact chart containing the sea coasts of Europe, Africa and America* (1678); Thornton, *A chart of the sea coasts of Europe, Africa, and America* (1683)

[84] Blome, *A new map of America septentrionale*, (1669)

labour, and he probably acquired a new plate. Although relying on Sansson's image did not display creative originality, it did not suggest laziness or limited investment on the part of the publishers, as historians of cartography have suggested. This same pattern can be seen on 165 of 176 maps analysed. The remaining 11 publications analysed probably required a small area of the plate to be re-engraved. For example Philip Lea and John Overton's *A New Mapp of America* (1684) was based on an earlier map of Overton probably from 1668, but included additional information in La Plata region and Pensilvania.[85] No publications were exact replicas of previously published maps. This suggests that all maps and charts of the Americas published in London required the labour and craftsmanship of an engraver to a greater or lesser extent. It is impossible to know the hours spent by engravers on each of the 176 maps analysed, but using the estimates derived from the hourly fee charged by Wenceslas Hollar and fees paid by George Willdey, it is possible to make some suggestions. Figure 10 suggests that two plates for a map of North America required 400 hours of labour from engraver Emmanuel Bowen, or 200 hours per plate. The number and size of plates used in the 176 maps varies, but using the available evidence, it suggests that if each map required at least one full size plate (one for printer), it would have provided around 35,000 hours of engraving labour and investment of £1760 by publishers. This suggests that publishers invested significant capital in the trade in colonial America maps and it was a significant source of work for engravers.

[85] Lea and Overton, *A new mapp of America* (1684)

Figure 58: New or re-engraved plates produced for publication of maps of Americas in London 1658-1721

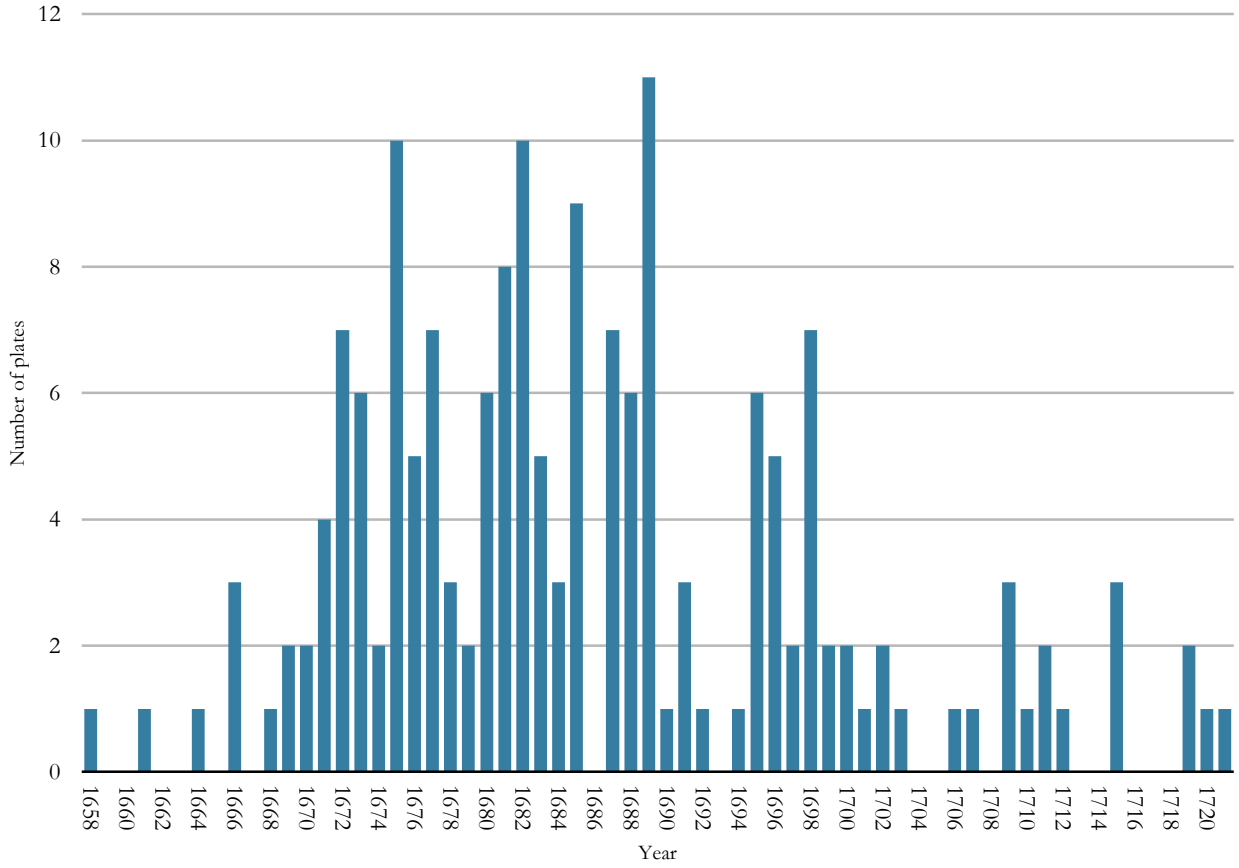


Figure 59: Jan Jansson, *America septentrionalis* (Amsterdam, 1654)

Reproduced with permission of the New York Public Library

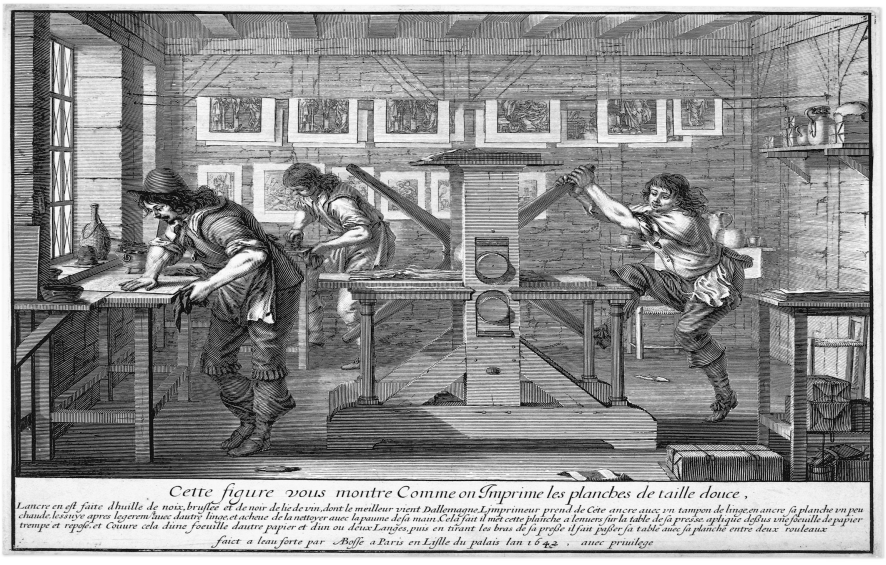
Figure 60: Richard Blome, *A new mapp of America Septentrionale* (1669)

Reproduced with permission of the New York Public Library

Figure 58 shows that the pace of production of new or significantly re-engraved plates was uneven between 1657 and 1721. Between 1658 and 1670 production of new or re-engraved plates was between 1 and 3 per year, with no maps from new or re-engraved plates published in some years. Between 1671 and 1700 annual production rose, to 10 in 1675 reaching a peak of 11 in 189. After the publication of 7 maps estimated to be from new or re-engraved plates in 1698, the annual number decreased, falling below three again between 1699 and 1721. This trend shows that demand for new or re-engraved plates maps and charts was not linear, and reaffirms that the trade was subject to fluctuations. Although evidence is limited, it could be explained by a spurt in production of maps in the 1670s-1690s to meet demand for information following the issuing of a charter to the Lords Proprietor in Carolina in 1663, and the growth in value of trade from the Caribbean colonies in the 1670s and 1680s. The depression and reduction in export earnings in the 1690s could be seen in the fall for demand for new publications and therefore decrease in production of new or heavily re-engraved plates. On the other hand, the varying nature of demand could be seen in the nature of consumption of maps and geographical information themselves. The first years of publication of information about new or rapidly growing colonies may have met initial demand and interest, after which just smaller revisions to information were necessary rather than larger scale production of new images, which may not have found commercial support from map-buyers who already owned maps or charts of the Atlantic colonies.

Printing and colouring

Figure 61: Abraham Bosse (Paris, 1641)
Image courtesy of British Museum



Finally, once the image was drawn and the plate engraved, the publisher could begin printing copies using a rolling printing press. Maps were commonly printed on paper, but occasionally onto cloth. Maps and charts were advertised as printed on atlas paper, imperial paper, royal paper and onto cloth.[86] 26 of 33 maps advertised in the *Term Catalogues* were printed on paper, and the remaining 7 were advertised as 'pasted on cloth', suggesting that paper was the dominant material.[87] Small amounts of water were applied to the paper to make the ink more likely to stick and soak into the paper. Ink was applied to the plate using a roller, which was then placed facedown onto the paper, which was set on one side of the rollers. Abraham Bosse depicted a young boy, probably an apprentice, pulling the press levers to propel the paper and plate through the rollers, allowing the printed image and plate to emerge on the other side. Printed papers were hung for up to a week to cause the ink to dry. This process was less instrumental in determining the appearance of the map (although a bad printing job could certainly affect the aesthetic quality of the image), but still incurred costs to the publisher.

Some publishers, such as Philip Lea discussed earlier, had their own rolling-presses, but the majority seem to have used specialised printers.[88] John Whitwood advertises himself as 'one who prints all sorts of Mapps, Prints for Books, shop-keepers bill, or whatever else is engrav'd on copper plates'.[89] For his *Atlas Maritimus* (1675) John Seller employed printer John Derby. According to Tycke James Moxon owned a press, but Sutton Nichols, Francis Lamb, and Herman Moll, did not'.[90] A rolling press does not appear to have been prohibitively expensive, as suggested by New Oxford Press purchase of a rolling press in 1669 for £5.1s.6d.[91] The decision not to purchase their own presses is probably therefore to have been related to publisher's own skills and the time they wished to spend on printing rather than commissioning or running their businesses. It further highlights the separation of skills in the map trade. The separation of the publisher from printing practice in London is further highlighted by a comparison with a description of Blaeu's workshop in Amsterdam. A contemporary in 1637 described Blaeu's new workshop, which had nine flat bed presses and six for copper plate printing:

> fronting on the canal is a room with cases in which the copper plates are kept, from which the Atlases, the Books of the Cities of the Netherlands and foreign countries, also the Mariners' Atlas and other choice books are printed, and which must have cost a ton of gold. Next to this first room is a press room used for plate printing and opening the cross street referred to above is a place, where the type, from which impressions have been made, are washed; then

[86] 'A new map of the world, in 8 Royal Sheets of paper, seven foot long and about five in depth; being a convenient size of a chimney piece; with many corrections and emendations not heretofore published in England. All made and sold by John Seller.' *Term Catalogues* Vol 1, May 1679
[87] Edward Arbor, *Term Catalogues, Vols.1-3* (1903)
[88] Helen Smith highlights that the book printing trade was far from reserved for men. Helen Smith, *'Grossly material things: women and book production in early modern England* (Oxford, 2012)
[89] John Whitwood trade card, BL, Bagford Harleian MS 5947 Item 107
[90] Tyacke, *My head is a map*, p. 73
[91] Griffiths, 'The Print', p. 120

> follows in order the room for book printing, which resembles a long hall with numerous windows on either side.[92]

Brown argues that Blaeu has designed the presses himself, 'making the first substantial improvements in the moving parts that had been made since the invention of printing'.[93] It seems probably that Joseph Moxon who visited Amsterdam and wrote *Mechanick exercises* (1683) was influenced by the development of these techniques when he wrote 'there are two sorts of presses in use, viz. the old fashion and the new fashion.'

The costs of printing included the labour and materials. According to D.F MacKenzie, in 1699 printer James Child charged 9d per 100 impressions, but in 1705, the price dropped to 8d, and in 1708 Thomas Hearne recorded price of 10d per 100.[94] According to Griffiths, Atlas paper cost was £4 10s a ream (480 -500 sheets), and imperial paper £5.10s a ream. Printing on it cost 14s per hundred sheets. Tyacke estimates that Garrett would probably had paid about 8s 6d for a ream of paper. To print a run of 500 maps, as George Willdey did, would cost 45d for the printer, and between £4 10s and £5.10s for paper, totalling around £5.10s.45d, or according to Tyacke's figures 8s.51d In comparison to £20 for the cost of two plates for Willdey's map of North America, printing was less costly but still significant at around 1/4 of the engraving cost.

Colour could also be added by hand to printed images. Eight in 45 maps advertised in the *Term Catalogues* offered an option to buy a colour version. In 1677 Joseph Moxon advertised a map of the world at the price of 2s.6d, rising to 3s with the addition of colour.[95] Colour was probably added at the specific request of a patron or customer, and tended to highlight particular geographical or topographical features – John Seller's 1672 map of Jamaica featured colour on parish boundaries lines (which were a new addition to maps of Jamaica) and around the edges of the island and on topographical detail within the island. The strongly coloured boundaries served to highlight the inclusion of parish boundaries in comparison to earlier maps of Jamaica which had not demarcated the parishes, and therefore highlighted the novelty of the information. Colour was also included in fine detail on the cartouches and on decorative information, enhancing the aesthetic appeal of the map. In short, it was used to increase the value of the map to the publisher, as it enabled them to sell it a higher price - an additional 14d in the case of Moxon.

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[92] Lloyd A. Brown, *Story of maps* (1949), p. 173
[93] Ibid
[94] Barnard and McKenzie eds., *The Cambridge history of the book: volume 4 1557-1695* (Cambridge, 2002), p. 93
[95] 'A mapp of all the world, containing about four foot in length and above three foot in breadth; wherein is laid down the situation of all places, according to their true longitude and latitude, and consequently their true distance; with apt instructions for the true understanding this mapp, or any others. Set forth by Joseph Moxon, and sold by him. Sheets uncoloured, with descriptions 2s. 6d. Coloured, with descriptions, 3s. Pasted upon cloth and coloured with Roller and Ledge 10s.' Arbor, *Term Catalogues*

Figure 62: John Seller, *Novissima et accuratissima insulae Jamaicae* (London, 1672)

Original in the John Carter Brown Library at Brown University

Conclusion

Imperial expansion in the Americas created demand for labour and skill in printed map production, specifically in drafting, engraving and printing. These skills were instrumental in determining the visual appearance of American geography to map consumers in the empire. Ability to perform precise and technical drafting was crucial in determining the fidelity of printed maps to the manuscript geographical data collected in the colonies, and therefore the relative accuracy of maps and charts, and the type of information communicated about imperial geography. Interaction between the engraver's hand and the copper plate fundamentally also determined the final appearance and accuracy of the image. An unsteady hand, or a momentary slip of the burin could crucially alter the shape of a coastline or harbour. Costs of labour and copper material also played a role - mistakes could be rectified, or geography altered, by re-engraving a section of the plate, but this required the engraver to smooth the chosen area and work the new detail into the plate again.

The relative permanence of the plate was also significant - print runs from single plates are estimated to run up to 200 prints - meaning that a single plate would produce 200 maps.

Cutting and pasting was the main method in designing and publishing a new map or chart, which required the ability to select and adapt images, to create a coherent image from multiple different sources (of different style and size), to copy information accurately and, in some cases, to plot new information. Furthermore investment in new or re-engraved copper plates was high in London map trade. In the absence of a centralised institution to survey the colonies and to act as a repository for the expanding geographical understanding of empire, the fluid nature of the printed market meant that the graphic understanding of the Atlantic world was co-ordinated and updated by publishers. Printed maps and charts acted in a material, textual and graphic dialogue, and the limitations of enforceable copyright meant that publishers were able to select from others what they considered to be the most up-to-date information thereby pushing the sum total of geographical representation further than the finances of an individual publishers would facilitate.

Conclusion

In 1724 Philip Zollman wrote to Hans Sloane from Stockholm to propose that he send a map draft to London.[1] Zollman had become the Royal Society's assistant secretary for Foreign Correspondence after moving from Germany to England in 1714, and in 1724 he was secretary to the British Ambassador-designate to Stockholm.[2] In his letter to Sloane he described a map of Grand Tartary, or modern day Central Asia, as an 'improvement' on previous maps, particularly ones in the Swedish version of the *Philosophical Transactions,* the *Acta literaria Suecia.* Zollman proposed that the drawing should be engraved in London. Zollman no doubt used his letter to assert to peers his ability to collect scientific scholarship in foreign countries, however his proposal that the drawing, made by a 'very sensible man and a good scholar', be engraved specifically in England suggests that he had confidence that English artisans in the 1720s were the go-to craftsmen in Europe to engrave valuable geographical information. This was a marked shift from 100 years earlier when English manuscripts were sent to the Low Countries for Dutch craftsmen to apply their skills, and highlights how London's role in the European knowledge economy grew between 1660 and 1720 at the same time that imperial demands expanded.

This thesis has argued that demand for information to support and expand empire propelled a series of trends in late-17th and early-18th century Britain that indicate that a significant market place for the collection and production of useful geographical knowledge had developed in London by 1720. This nuances historiographical narratives that suggest that Britain lagged behind European rivals in map making and did not contain sufficient skill or expertise to produce valuable geographical information. It fills a hole in existing literatures that rarely analyse the intersection of economic interests in empire and trade with scientific enterprise or production of knowledge, and it suggests that the desire to access useful knowledge to be applied to material exploitation of the environment was a driving factor behind the development of early modern science. It also highlights that by contributing labour and skill, print artisans were a crucial part of the imperial machine, and that the demand for useful knowledge of empire provided labour and pressure on the skills of artisans.

The driving factor behind these changes was the challenge of navigating the Atlantic and Pacific oceans and building sufficient knowledge of the colonies to make optimised decisions how best to exploit the spoils of empire. To service growing colonial trade, greater volumes of manufactures and other commodities, including enslaved people as contemporaries saw it, were transported across the Atlantic on boats that originated in London and returned capital to merchants and elites in the capital. Knowledge about the location of ports, harbours and islands, as well as finer detail about how to navigate their coastlines, the position of dangerous rocks, tidal changes, water depths and even how to find fresh water also became a valuable commodity for mariners, merchants and settlers. Between 1660 and 1720, this type of useful information was

[1] Sloane MS 4047 f. 282, British Library
[2] Derek Massarella, 'Philip Henry Zollman, the Royal Society's first Assistant Secretary for Foreign Correspondence', *Notes and Records of the Royal Society of London* 46:2 (1992), pp. 219-234, p. 225

printed on 179 maps and charts made in London of the Americas, and artisans based in the capital became the European market leaders for maps of colonies such as Jamaica and Barbados. In the case of Jamaica, 80% of the maps of Jamaica printed in Europe between 1661 and 1719 were printed in London.

Demand for new and accurate geographical information came from individuals, institutions, and communities involved in commercial and imperial expansion, including the Crown, Board of Trade, Royal Society, Royal Mathematical School, South Sea Company, Board of Trade, mariners, gentlemen philosophers, and senior 'policymakers' involved in empire such as Samuel Pepys and Hans Sloane. The 335 ships entering London in 1686 from the Atlantic colonies constituted demand for maps, charts and instruments from around 1,675 individual mariners. In one case of state involvement, the Lords of Trade and Plantations Committee spent £148 between 1678 and 1696 on maps and charts, probably around 1500 maps, while the Royal Mathematical School spent £1826.5s.46d in 1673-1720 on maps and charts from ten sellers, instruments from 27 makers, and books from seven publishers in London. Royal Society fellows experimented with instruments to solve maritime and navigation questions and printed observations including about the size of Barbados and its coastal environment from mariners and curious natural philosophers in the pages of *Philosophical Transactions*. Demand was also in intellectual and aesthetic form, in terms of shaping maps' geographical contents, form and style, in particular the strong emphasis on including useful and practical information as asserted in map titles, dedications and cartouches but most importantly in the emphasis on coastlines, rocks, scales, latitude and longitude marks and the other forms of useful information included in the maps and charts.

Although limited documentary evidence makes it difficult to assess the precise volume of demand from each institution or group, it is clear that demand remained fragmented throughout the period rather than concentrating in one or two institutions. This was due to the private nature of the development of early British American empire, which was largely carried out by individuals rather than merchant companies as in the case of the East Indies. Without a centralised driver of the market, publishers had to rely on the changing fortunes and requirements of a series of institutions and individuals. It also highlights the multiple uses of geographical knowledge - mariners, the Royal Mathematical school and policymakers like Samuel Pepys used geographical knowledge for practical navigation reasons, whereas the Crown and the Board of Trade supported the collection of information in order to extend British imperial interests and justify territorial claims, and individuals like Hans Sloane and the Royal Society were interested in natural knowledge of new lands. These interests overlapped and publishers were largely able to supply multiple requirements either from the same business or using the same objects. Demand was also in the form of specific commissions from and general commercial demand to which publishers responded to by investing in map production or by changing the type of information included on the maps and charts to content they believed would be appealing and therefore commercially successful.

Map makers, publishers and mariners were required to produce information about established colonies or regions and for newly acquired or aspirational empire in new markets, particularly in the South Seas. The

majority of maps published reflected the dominant parts of empire where most profit and growth occurred, namely Jamaica and Barbados and parts of the eastern seaboard of the north American colonies. There was growing emphasis on publishing information that could help develop markets by expanding geographical knowledge of Spanish America and the southern Atlantic and Pacific oceans, as the grip by Spain on the region loosened at the end of the 17th century. Within these maps, coastal and navigation information dominated - shapes of coastlines, water depths, position of rocks, and location of inlets or harbours, rather than information about settlements or allegorical or fantastical imagery or text, as had been the case in early-17th century and Renaissance maps. The inclusion of coastal and navigation information reflects the information accessible to mariners and map makers, as penetration into the interior of the American colonies and parts of the Caribbean islands was limited. Also reflected the demand for this type of useful and practical information, which clearly had commercial appeal due to the space dedicated to it by competitive publishers who relied largely on consumer demand.

The relationship between demand for knowledge of empire and geography, supply of manuscript information, and publication of printed maps is reflected in three case studies of how economic and political interest in Spanish America from the 1660s onwards created supply of raw information from a range of actors including on a Crown-sponsored voyage by Captain John Narborough in the Straits of Magellan, by buccaneers who acted outside the confines of the law but had access to territory and information inaccessible to ordinary merchants or mariners, and by mariners and settlers on Company voyages to Spanish America. Supply of maps of the Magellan straits and Ports San Julian, Desire and Valdivia by John Narborough, and manuscript drawings and textual accounts from buccaneers was part of decades of interest by English merchants and political elites in Spanish America. Highlights from the information they provided informed subsequent decisions about potential settlements, trade routes or military incursions by the Company of Scotland in Darien and the South Sea Company. Buccaneer information collection was conditioned by their itineraries and desire to make profit - creating a paradox in which they collected some of the most comprehensive information about Spanish America but with significant gaps, sparse detail and occasional errors. Interested agents in Britain had no other option but to consult this information due to the uniqueness of buccaneer access to coveted geographical spaces. This demonstrates the drawbacks and benefits of relying on private agents to produce reliable geographical information. At the same time, chartered Companies collected some information by virtue of their trading activities in Spanish America, but they did not commission large-scale scientific studies of the region and capitalised largely on information already in the marketplace. Thus the market for useful knowledge was fragmentary and rested on contingencies of trade and access to territory rather than concerted campaigns by scientific organisations or merchant companies.

In addition to supply of information from Spanish America, settlers in the colonies also provided information, for example the Governor of Jamaica sent a manuscript map to London in 1671, and mariners such as John Taylor made drawings or wrote descriptions of their voyages or conditions they observed in ports

and harbours. The full extent of the supply of this information is difficult to estimate due to limited preservation of manuscript material from disparate actors - it has not been possible to trace an exact supply chain from colonial settler to artisan's workshop. Publishers also borrowed and adapted information from previously published maps and texts to augment manuscript information. In London geographical information was turned into a variety of forms, including maps, charts, atlases, and geographical and navigation texts. This reflected the diverse form of representation of information that was in demand - geographical information did not have to be represented in visual form alone, but also in texts and drawings. This highlights the diversity of geographical understanding that existed, and highlights how navigators and settlers drew upon a range of skills and forms of knowledge to make geographical decisions. The map and chart trade expanded. Between 1640 and 1660, 5 maps of the Americas were published in London, and in the following two decades, 1660-1680, 57 maps individual editions were published - an eleven-fold increase. The number of publishers selling these items tripled - reaching a peak of 13 in 1695-1700. A singular publisher specialising in American geography did not emerge, which suggests that the publishing market was more diffuse than in rival countries such as the Low Countries. However, it also suggests that although demand was increasing, it was not sufficiently large enough yet to merit publishers specialising in American geography at the expense of other output.

The expansion of the map trade coincided with changes in natural philosophy – increased valorisation of eyewitness knowledge, empiricism and a respect for the idea of accuracy and novelty. These values were reflected in map and chart titles chosen by publishers that asserted they were new and accurate, and promoted claims that information was derived directly from people in the colonies. This valorisation of eyewitness empirical knowledge benefitted the market for geographical information of empire because geographical information was something that could easily, if not always correctly, be claimed to be correct or incorrect, accurate or inaccurate. The longitude and latitude of an island or harbour was information that could on the surface easily be understood by a consumer as having been wrong in the past and subsequently corrected. In the case of distant geographical information, publishers could also assert the uniqueness of the information published because there was little recourse for consumers to crosscheck, and there was added value in the clearly eyewitness nature of information recorded at source by a mariner or settler. But more significantly, the changing culture of empiricism also reflected itself visually and semantically, and in the high volumes of useful and practical information represented in maps and charts. Some geographical information was represented in tabular form, such as tables of longitude and latitude of South America, giving an impression of comprehensiveness and suggested that the map user could use the information to produce other information, further highlighting the intended utility of the objects.

Maps of the Americas displayed large amounts of useful geographical information, more so than decorative cartouches or sea monsters. 88 maps or charts had shoals or sand banks drawn, and 48 depicted water depths. Coastal information dominated, and map publishers also employed visual strategies to promote the economic and political potential of empire, balancing assertion of territorial sovereignty of new and

aspirational colonies with careful statements about fortunes that could still be made in the Americas to invite further investment and settlement. Images of trades and manufactures, as well as practical ordinary navigation information helped to promote the empire as a place where mariners, merchants and settlers could make a fortune but with appropriate and available information - increasingly distant from the romanticised and exoticised depictions of American colonial spaces in the early-17th century and 16th century. On a commercial market, publishers were adopting aesthetic norms that they believed would satisfy their consumers, highlighting the currency in displaying useful but economically potent information. Geographical information was represented in a wide variety of forms, including maps and charts which sometimes combined territorial and oceanic or water-based information into one form instead of keeping them distinct. Publishers too sold multiple types of cartographic objects rather than specializing, and the collection of new information and skills applied to the production of both maps and charts.

This thesis has also shown that growing need to produce knowledge about the geography of empire shaped the skills and demand for labour in London. The work of draftsmen, engravers, printers and publishers were required to produce maps and charts, highlighting the extent to which craftsmen were needed to support imperial expansion. Although the actual technical skill of drawing a map or engraving an image to a copper plate did not significantly differ from drawing decorative images such as a portrait or illustration, the need for precision drawing and exact replication differentiated it from ordinary drafting and engraving. The challenge of drawing coastlines and other features that were supposed to represent actual physical features highlights the instrumental role of print artisans in creating geographies of empire and in either supporting or hindering the use of this information. Bibliographical evidence about the map drafters, engravers and printers is very limited. The common profile of a print artisan during this period did not include travel to the Americas and direct involvement in the mercantile or political aspects of the empire. This research has found that despite this, their skill and labour were pivotal in creating images and information about imperial geography that was used by a range of actors and institutions who were crucial in constructing and extending empire. These artisans also reaped the financial rewards of performing this labour, and although renumeration was likely not very different to payment for other type of print production, it highlights how the financial gains of empire spread further beyond merchants, plantation owners and sea captains that are usually the focus of historians.

Although scant empirical evidence of business records and workshop practice remains, analysis of extant printed maps can provide estimates of the application of labour and skill to produce maps. Analysis of contemporary print methods and of patterns of information of maps and charts themselves suggests that the area where skill was most different for producing American maps and charts was in the drafting. Analysis of patterns of information on maps and charts suggests that newly published items were often created using a 'cut and paste' method whereby facets of previously printed information were adapted for new publication, alongside incorporation of new pieces of information perhaps from manuscript accounts made in the colonies. After a draft had been made, the image was engraved onto a copper plate using a range of tools and a printed

map was drawn from the plate using a rolling press. Plates could be made from scratch, or alterations could be made to an existing plate by re-working a section and re-engraving it, usually to alter a title or small area of the map. Historians have argued that this was prevalent and testimony to the laziness of English map makers, yet the majority of maps were sufficiently different from other publications to appear to have required a new plate. 95% of maps and charts of the Americas published in London between 1660 and 1720 probably required significant re-engraving or the production of a new copper plate and the remaining 5% used plates that had been partially re-engraved to change information. No significant break-throughs in printing or drafting technology occurred during the period, indicating that exploration of empire could rest on increased application of old and established skills. But it also showed that skills and techniques previously reserved for either decorative aesthetic items or for scientific drawing could be used in the construction of empire and aiding of expansion – creating a marriage between artistic practices and the pursuit of profit and territorial power.

In summary, the geographical knowledge economy that emerged from empire and supported it included a wide range of actors, including artisans with limited connections to imperial enterprise beyond supplying their skill and labour. Empire supported and was supported by these artisans and trades in London, and the ongoing changes in natural philosophy in London supported the provision of accurate and precise geographical information that could aid ships and merchants better transport goods – both material and human – across the Atlantic, and better exploit the resources of the New World. A range of individuals and institutions created demand for useful knowledge to aid in crossing the Atlantic, entering the numerous ports and coves, and avoiding rocks and shoals that could threaten valuable cargoes. This research has shown that the tentacles of the British empire spread far beyond the dockyards and workshops of Wapping.

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Appendix I: List of maps and charts of the Americas published in London 1660-1720

Map publishers

Publisher	Title
Thomas Bassett and Richard Chiswell	A new description of Carolina (1670)
Thomas Bassett and Richard Chiswell	Map of New England and New York (1675)
Thomas Bassett and Richard Chiswell	Map of Virginia and Maryland (1675)
Thomas Bassett and Richard Chiswell	Jamaica
William Berry	To Captain John Wood this map of the world according to the mercators projection (1676)
William Berry	Tabula Jamaicae Insulae by Edward Slaney (1678)
William Berry	North America, divided into its principal parts where are distinguished the several states which belong to the English, Spanish, and French, to the most serene and most Sscred Majesty of Charles II (1681)
Richard Blome	A new map of America Meriodionale (1669)
Richard Blome	A generall map of Carolina (1670)

Richard Blome	A new and exact map of the island of Jamaica (1672)
Richard Blome	A draught of the rivers and sea in the coasts of America (1672)
Christopher Browne	A new map of Virginia, Maryland, and the improved parts of Pensilvania and New Jersey (1692)
Christopher Browne	A new map of the island of Jamaica (1700)
Edward Crisp	A compleat description of the Province of Carolina in 3 parts 1st, The improved part from the survey of Maurice Matthews & Mr John Love; 2ly The West part by Capt. Tho. Nairn, 3:ly A chart of the coast from Virginia to Cape Florida (1711)
Joel Gascoyne	To the Right Honourable Will. Earle of Craven, Pallentine and the rest of ye True and absolute Lords and Propietors, of the province of Carolina, this map is humbly dedicated to Joel Gascoyne, a new map of the country of Carolina with its rivers, harbors, plantations, and other accommodations, done from the latest surveighs and best informations by order of the Lords Proprietors. (1682)
Charles Harper	An exact map of Jamaica (1683)
Thomas Jenner	A new and exact map of America and Ilands the revento belonging (1666)
Philip Lea	A generall map of the continent and islands which bee adjacent to Jamaica, by Philip Lea globe maker (1685)
Philip Lea	The principal islands in America belonging to the English Empire viz Jamaica, Barbados, Antegoa, St. Christophers (1696)
Philip Lea	Virginia and Maryland (1696)
Philip Lea	Pennslyvania and West Jersey (1696)
Philip Lea	The harbour of Boston or Matachusets bay (1696)
Philip Lea	Newfoundland (1696)
Philip Lea	A new map of New England from Cape Codd to Cape Sables describeing all the sands shoals rocks and difficulties together with a sand draft of the Mattathusetts bay exactly surveyed by the Author (1691)
Philip Lea, John Overton	A New Mapp of America Devided According to the Best and latest Observations and Discoveries wherein are described by their Proper Names the Seaverall Countries that Belonge to ye English which are wholly left out in all French and Dutch maps (1684)
Herman Moll	America (1695)
Herman Moll	A map of English Plantations in America (1695)
Herman Moll	A view of the general and coasting trade-winds in the Great South Ocean (1699)

Herman Moll	A map of the Bay of Campechy (1699)
Herman Moll	A new and exact map of the coast, countries and islands within ye limits of the South Sea Company (1711)
Herman Moll	A new map of the North Parts of America claimed by France under ye names of Louisiana, Mississipi, Canada, and New France, with ye adjoining territories of England and spain (1720)
Herman Moll	John Lord Summers this map of North America (1712)
Herman Moll	A new and exact map of the dominions of the king of great britain on the contient of north america containing newfoundland, new scotland, new england, new york, new jersey, pensilvania, maryland, virginia, and carolina, according to the newest and most exact observations (1715)
Herman Moll	A map of the West Indies or the islands of America in the North Sea (1709)
Herman Moll	A map of the middle part of America (1697)
Herman Moll, Philip Overton	To the Right Honourable Charles of Sunderland, and Baron Spencer, this map of South America (1709)
Robert Morden	The north West part of America (1680)
Robert Morden	No title [America] (1680)
Robert Morden	The Western Islands (1680)
Robert Morden	Carolina, Virginia, Maryland & New Iarsey (1680)
Robert Morden	New England and New York (1680)
Robert Morden	A new map of Virginia and Maryland (1680)
Robert Morden	A new map of New Mexico (1687)
Robert Morden	The northwest part of America (1688)
Robert Morden	A new map of Carolina (1688)
Robert Morden	A map of Florida and the Great Lakes off Canada (1688)
Robert Morden	A new map of New England and New York (1688)
Robert Morden	A new map of New Jarsay and Pensilvania (1688)
Robert Morden	A new map of Virginia (1688)
Robert Morden	New Mexico vel/ New Granata/ et Marata/ et California (1688)

	A draft of the Golden & Adjacent Islands with part of ye isthmus of Darien as it was taken by Captain Jenefer where ye Scots West India Company were settled, and a new map of ye Isthmus of Darien in America, the Bay of Panama, the Gulph of Vallona or St Michael, with its islands & countries adjacent by William Hacke & Rt Morden (1699)
Robert Morden	A new map of the English Empire in America viz Virginia Maryland Carolina Pennslyvania New York New Jarsay New England Newfoundland New France (1698)
Robert Morden	A map of ye English Empire in ye continent of America (1679)
Robert Morden, John Thornton	To the Right Honourable Will. Earle of Craven, Pallentine John Earl of Bath, George Lord Cartaret, Anthony Lord Ashley, Sr John Colleton Barr, Thomas Archdale, Thomas Amy and the Hiers of Seth Sothell Esq, This new map of the chief rivers, bayes, creeks, harbours and settlements in South Carolina actually surveyed is humbly dedicated by John Thornton. (1695)
Robert Morden, William Berry	A new map of the English Plantations in America (1673)
Robert Morden, William Berry	A map of New England, New Yorke, New Iersey, Maryland & Virginia (1685)
Joseph Moxon	A new mapp of Jamaica according to the last Survey (1677)
Joseph Moxon	Plat of all the world (1657)
Joseph Moxon	America Septentrionalis (1664)
Joseph Moxon	No title [of America] (1670)
Joseph Moxon	No title (1670)
William Mount	A new mapp of the Island of St Christophers being an actual survey taken by Mr Andrew Norwood Surveyor General (1706)
Richard Mount	A general chart of the West India (1695)
Richard Mount, Jeremiah Seller	A new general chart for the West Indies of E Wrights Projection (1703)
John Ogilby	Novissima et acuratissima totius America (1671)
John Ogilby	Novissima et acuratissima totius Barbadoes (1671)
John Ogilby	Noua Terrae-Mariae tabula (1671)
John Ogilby	Novissima et acuratissima descriptio Jamaicae (1671)
John Ogilby	A new discription of Carolina by order of the Lords Proprietors (1673)
John Overton	A new and most exact map of America described by N I Vischer (1668)

John Overton	A new map of the island of Barbadoes wherein every parish, plantation, watermill & cattle mill is described with the name of the present possessors and all the things remarkable according to a late exact survey thereof (1675)
Charles Price, John Senex	North America corrected from the observation communicated to the Royal Society at London and the Royal Academy at Paris by John Senex (1710)
Charles Price, John Senex	South America corrected from the observations communicated to the Royal Society's of London and Paris (1710)
John Seller	A chart of the Sea Coast of Brazil, from Cape St Augustine to the Streights of Magellan (1672)
John Seller	A chart of the West Indies from Cape Cod to River Oronoque (1673)
John Seller	A chart of the North Part of America, describing the Sea Coast of Groenland, Davies Streights, Baffins Bay, Hudsons Streights, Buttons Bay, and James Bay by John Seller Hydrographer to the King (1673)
John Seller	A chart of the Coast of America from New found Land to Cape Cod (1674)
John Seller	A chart of the Western Ocean (1674)
John Seller	A chart of the Cariby Islands (1675)
John Seller	Novissima et acuratissima descriptio Jamaicae per Johannum Sellearum (1675)
John Seller	The Windward passage from Jamaica betweene the East End of Cuba and the West end of Hispaniola. (1675)
John Seller	A chart of the sea coasts of New England, New Jarsey, Virginia, Maryland and Carolina From Cape Cod to C Hatteras (1675)
John Seller	A map of New Jersey (1675)
John Seller	A chart of the South Sea (1675)
John Seller	A general chart of the West Indias (1676)
John Seller	A map of New England (1676)
John Seller	A map of New Iarsey (1677)
John Seller	A map of Mexico, New Spain (1679)
John Seller	A chart of the Western Ocean according to the Mercators Projection (1681)
John Seller	A chart of the Coast of America from New found Land to Cape Cod (1682)

John Seller	A chart of the sea coasts of New England, New Jarsey, Virginia, Maryland and Carolina From Cape Cod to C Hatteras (1682)
John Seller	A chart of the Western Ocean (1682)
John Seller	Carolina newly-described (1682)
John Seller	Virginia and Maryland (1682)
John Seller	New England and New York (1682)
John Seller	The island of Tobago (1682)
John Seller	A chart of the West Indies From Cap Cod to the River Oronoque (1682)
John Seller	New Iarsey (1684)
John Seller	North America (1684)
John Seller	A chart of the West Indies from Cape Cod to the River Oronoque [by John Seller, Hydrographer to the King] (1685)
John Seller	A new chart of the Sea Coast of Newfoundland, new Scotland, new England, new Jersey, Virginia, Maryland, Pensilvania, and part of Carolina (1685)
John Seller	No title, [in Almanack for the Province of Virginia & Maryland] (1685)
John Seller	New England [in New England amanack] (1685)
John Seller	A Mapp of New-found-land (1685)
John Seller	A Map of Pensilvania (1690)
John Seller	The North Part of America (1695)
John Seller	Newfoundland (1695)
John Seller	Carolina newly-described (1682)
John Seller	Virginia and Maryland as it is planted and inhabited this present year 1670 surveyed and exactly drawn by Augustine Herrman (1673)
John Senex	South America corrected from the observations communicated to the Royal Society's of London and Paris (1715)
John Senex	New map of the English Empire in the Ocean of America or West Indies. Revis'd by J. Senex (1719)
John Senex	A new map of Virginia, Maryland and the improved parts of Pennslyvania (1719)
John Senex	A new and exact map of Barbados, according to survey by William Mayo (1721)

John Thornton	A general chart from England to Guinea with all the trading parts of the West Indies (1672)
John Thornton	A new map of the North Part of America (1673)
John Thornton	A chart of the North Part of America For Hudsons Bay comonly called the North West Passage (1677)
John Thornton	A chart of the Sea Coasts of Europe, Africa, and America. From the North Parts of Scotland, to Capa Bona Esperanca and from Hudsons Straits to the Magellan Straits, according to Mr Wrights Projection (1683)
John Thornton	A general chart of the West Indies (1683)
John Thornton	A general chart of the West India (1683)
John Thornton	A chart of the island/ Cuba/ The Gulf of Florida/ with the Bahama Islands, and the Windward Passage (1687)
John Thornton	Part of New England, New York, East New Jarsay, Long Island (1687)
John Thornton	A new mapp of Carolina (1689)
John Thornton	The island of Jamaica [with inset] a draft of Port Royall and all ye kees (1689)
John Thornton	A new chart of the trading part of Newfoundland (1689)
John Thornton	Harbour Grace (1689)
John Thornton	Bay Bulls (1689)
John Thornton	Cattalina Harbour (1689)
John Thornton	Port Bonavista (1689)
John Thornton	A new chart of the Bahama Islands and the Windward Passage (1698)
John Thornton	A chart of the Island of Newfoundland with the particular harbors at large
John Thornton	A new chart for the seacoasts of Newfoundland New Scotland New England New Jarsey with Virginia and Maryland (1677)
John Thornton	A portraiture of the City of Philadephia in the province of Pennslyvania in America by Thomas Holme Surveyor General (1683)
John Thornton	The coast of Newfoundland from Salmon Cove to Cape Bonavista, described by Henry Southwood (1677)
John Thornton	The coast of Newfoundland from Cape Raze to Cape St Francis (1677)

John Thornton	A new mapp of East and West New Jarsey being an exact survey taken by John Worlidge (1698)
John Thornton	A map of the improved part of the province of Pensilvania in America, begun by Wil. Penn Propietary & Governor thereof Anno 1681. A map of the province of Pennsilvania, containing the three counties of Chester, Philadelphia & Bucks, as far as yet surveyed and laid out ye divisions & distinctions made by ye Coullers, Respects the Settlements by way of townships, by Tho. Holme Surveyor General London. (1687)
John Thornton, John Seller	A Map of Some of the South and east bounds of Pennsylvania in America, being partly inhabited [William Penn map] (1681)
John Thornton	A mapp of Virginia, Maryland, New Jarsey, New York & New England (1678)
John Thornton, William Berry	A new Map of Virginia, Maryland, Pensilvania, New Jersey, Part of New York, and Carolina […] To Mr Micajah Perry of London merchant, This map of Virginia is humbly dedicated (1698)
John Thornton, William Berry	A chart of the Island of Hispaniola (1689)
John Thornton, William Berry	Boston harbour (1689)
John Thornton, William Berry	Part of New England, sold by John Thornton (1689)
John Thornton, William Berry	A map of Virginia, Maryland/ Pensilvania/ East and West New Jarsey by John Thornton (1689)
John Thornton, John Seller	A chart of the West Indies (1677)
John Thornton, William Berry	A new and exact chart containing the sea coasts of Europe, Africa and America; From England to Cape Bona Esperanca & from Newfoundland to the Straits of Magellane, According to Mr Wrights Projection (1678)
Robert Walton	A new plaine and exact map of America, described by N I Visscher, and done into English, enlarged and Corrected according to Blaeu, with the habits of the countries, and the manner of the chief citties, the like never before printed (1658)
George Willdey	To his sacred & most excellent Majesty George This map of North America is most humbly dedicated (1709)

Book publishers who printed maps

Publisher	**Title**

George Alsop	A landskip of the province of Maryland or the Lord Baltimores Plantation neere Virginia by Geo Alsop Gent in *A character of the province of Maryland* (1666)
E Cotes	A new mapp of the Empire of Mexico describing the continent to the Isthmus of Panama In Thomas Gage, *A New Survey of the West Indies* (1655)
Nathaniel Crouch	The English Empire in America in *The English Empire in America* (1685
Samule Heyrick	A map of the whole territory traversed by John Lederer in his three marches in *The Discoveries of John Lederer, in Three several Marches from Virginia to the West of Carolina* (1672)
Robert Horne	Carolina described
M. Bentley, J. Tonson, H. Bonwick, T. Goodwin, and S. Manship	A map of a large country newly discovered in the Northern America Situated between New Mexico and the frozen sea together with the course of the great river Meschasipi dedicated to his Majesty William III by Father Lewis Hennepin Missionary (1698)
M. Bentley, J. Tonson, H. Bonwick, T. Goodwin, and S. Manship	A map of a New World between New Mexico and the Frozen Sea (1698)
James Knapton	A map of the world. Shewing the course of Mr Dampiers voyage round it, From 1679 to 1691 in *A New Voyage Around the World* (1697)
John Lawrence	America (1685)
Thomas Parkhurst	An exact mapp of New England and New York (1702)
Thomas Salisbury	America in *A most compleat compendium of geography* (1691)
Robert Scott	New Mexico in Jonas Moore, *A new geography* (1681)
Robert Scott	New England in Jonas Moore, *A new geography*(1681)
Robert Scott	Florida in Jonas Moore, *A new geography* (1681)
Robert Scott	Florida in Jonas Moore, *A new geography* (1681)
Robert Scott	America in Jonas Moore, *A new geography y* (1681)
Edward Wells	A new map of North America shewing its principal divisions, chief cities, townes, rivers, mountains etc, dedicated to his highness William Duke of Glocester (1700)
Edward Wells	A New Map of the Most Considerable Plantations of the English in America Dedicated to his Highness William Duke of Glocester (1700)

John Williams	Jamaica in Edmund Hickeringill, *Jamaica viewed* (1671)

Appendix II: Maps and charts in the Blathwayt Atlas, c.1683

Title	Region	Maker/ seller	Date originally published	Type
A new mapp of the world according to Mr Edward Wright commonly called Mercator's Projection	World	John Thornton		Engraved, colour added
To Capt. John Wood this map of the world drawn according to Mercators Projection	World	Robert Morden, William Berry		Engraved
A new map of the English Plantations in America, both continent and ilands, shewing their true sictuation and distance from England and from one another	North America	Robert Morden, William Berry		Engraved, colour added
A chart of ye North Part of America. for Hudsons Bay commonly called ye North West Passage	New-foundland	John Thornton, John Seller		Engraved, colour added
La Canada, ou Nouvelle France	New France	Nicolas Sanson	1656	Engraved, colour added
Newfoundland	New-foundland			Manuscript
New England	New England			Manuscript
Novi Belgii Novaeque Angliae Nec Non Partis Virginiae	Middle colonies			Engraved
A mapp of Virginia, Mary-land, New-Jarsey, New-York & New England.	Middle colonies	John Thornton		Engraved, colour added
A map of New England, New Yorke, New Iersey, Maryland & Virginia	Middle Colonies	Robert Morden		Engraved on vellum
- Another copy				Engraved on paper

A mapp of New Jersey, in America	New Jersey	John Seller, William Fisher	1677	Engraved, colour added
Long Iland siruaide by Robartte Ryder	Long Island			Manuscript
A map of some of the South and eastbounds of Pennsylvania in America	Pensylvania	John Thornton		Engraved, colour added
Maryland	Maryland			Manuscript
Virginia	Virginia			Manuscript
Carolina from Roanoke River to below Hilton Head	Carolina			Manuscript
Carolina from Cape Henry to St Augustine	Carolina			Manuscript
Albemarle Sound made by James Lancaster	Carolina		1679	Manuscript
A mapp of Virginia	Virginia		1651	Engraved
A new Map of the Country of Carolina	Carolina	Joel Gascoyne, Robert Greence		Engraved
A mapp or description of Sommer Islands sometime called Bermudas lying in the West Indies	Bermuda		1678	Manuscript
A chart of the Caribe Islands	Caribbean	John Seller		Engraved
Les Isles Antilles	Caribbean	Nicolas Sanson	1656	Engraved
Carte de Lisle de Sainct Christophe	Caribbean	Pierre Mariette		Engraved
L'Isle de la Martinique	Caribbean	Pierre Mariette		Engraved
The island of Tobago	Caribbean	John Seller		Engraved
Monserrat Island	Caribbean		1673	Manuscript
Isle de la Guadaloupe	Caribbean	Pierre Mariette		Engraved

A new map of the ssland of Barbadoes	Caribbean	John Overton, Robert Morden, William Berry		Engraved
Jamaicae descriptio	Caribbean			Engraved on vellum
Tabula Jamaicae Insulae per Edward Slaney	Caribbean	William Berry	1678	Engraved on vellum
Novissima et accuratissima Jamaicae	Caribbean	John Ogilby	1671	Engraved on vellum
A new mapp of Jamaica	Caribbean	James Moxon	1677	Engraved, colour added
Venezuela, cum parte Australi Novae Andalusiae	Spanish America	William Blaeu		Engraved
Surinam and Commewijne Rivers	East Indies			Manuscript
Caerte ofte vertooninge vande Riuieren van Suriname	East Indies		1671	Engraved
Accuratissima Brasiliae Tabula	Spanish America	Johan Jansoon	1640	Engraved
Paraguay	Spanish America	Johan Jansoon		Engraved
A new mapp of Magellan Straits discovered by John Narborough	Spanish America, South Seas	John Thornton	1673	Engraved
Bombay Harbour	East Indies			Manuscript
A chart of the seacoasts from the Landsend of England to Cape Bona Esperanca	Europe, Africa	John Seller	1675	Engraved
Guiana siue Amazonum	Spanish America	Johan Jansoon		Engraved
Aethiopia Inferior	Africa			Engraved
Nigritarum Regnum	Africa	Johan Jansoon		Engraved
Tabula Magellenica	Spanish America, South Seas	Johan Jansoon		Engraved